Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

NOVEMBER, 1959

CONTENTS:

Treatment of Combined Wastes
Application of Ion-Exchange

Conversion Coatings
Phosphate Films

Immersion Plating on Zircaloy-2
Coating Zirconium Alloy

The Electrochemical Society
Abstracts of Papers Presented

Science for the Coatings Technologist
Additives: Surfactants

Science for Electroplaters
Copper Plating — IV

Complete Contents Page 57

Read and pass on—

Pickling Problems?

CLEPO powdered pickling compounds

reduce the hazard, corrosion, fume, spray, handling and storage problems of raw acid cleaners.

Here are some of the CLEPO compounds formulated to meet the exacting requirements of specific applications.

IF YOUR PROBLEM IS	USE
Pickling steel in tumbling barrels	CLEPO 191-D
Removing corrosive stains and corrosion products from wrought aluminum	CLEPO 192-A
Rapid removal of scale and rust from steel and iron	CLEPO 198-JA
Cathodic electro-pickling to remove smut or scale from steel	CLEPO 193-R
Removing rust and scale from cold rolled steel with little or no smut formation	CLEPO 193-B
Removing tarnish and scale from brass or copper before barrel burnishing, lacquering, etc., and providing brass with 24-hour salt spray resistance	CLEPO 181
Deoxidizing bare or clad aluminum prior to spot welding, heliarc welding, etc.	CLEPO 180-S
Stripping anodize coatings and whitening cast aluminum alloys without using hydrofluoric acid	CLEP-ETCH "A" SALT / used with nitric acid

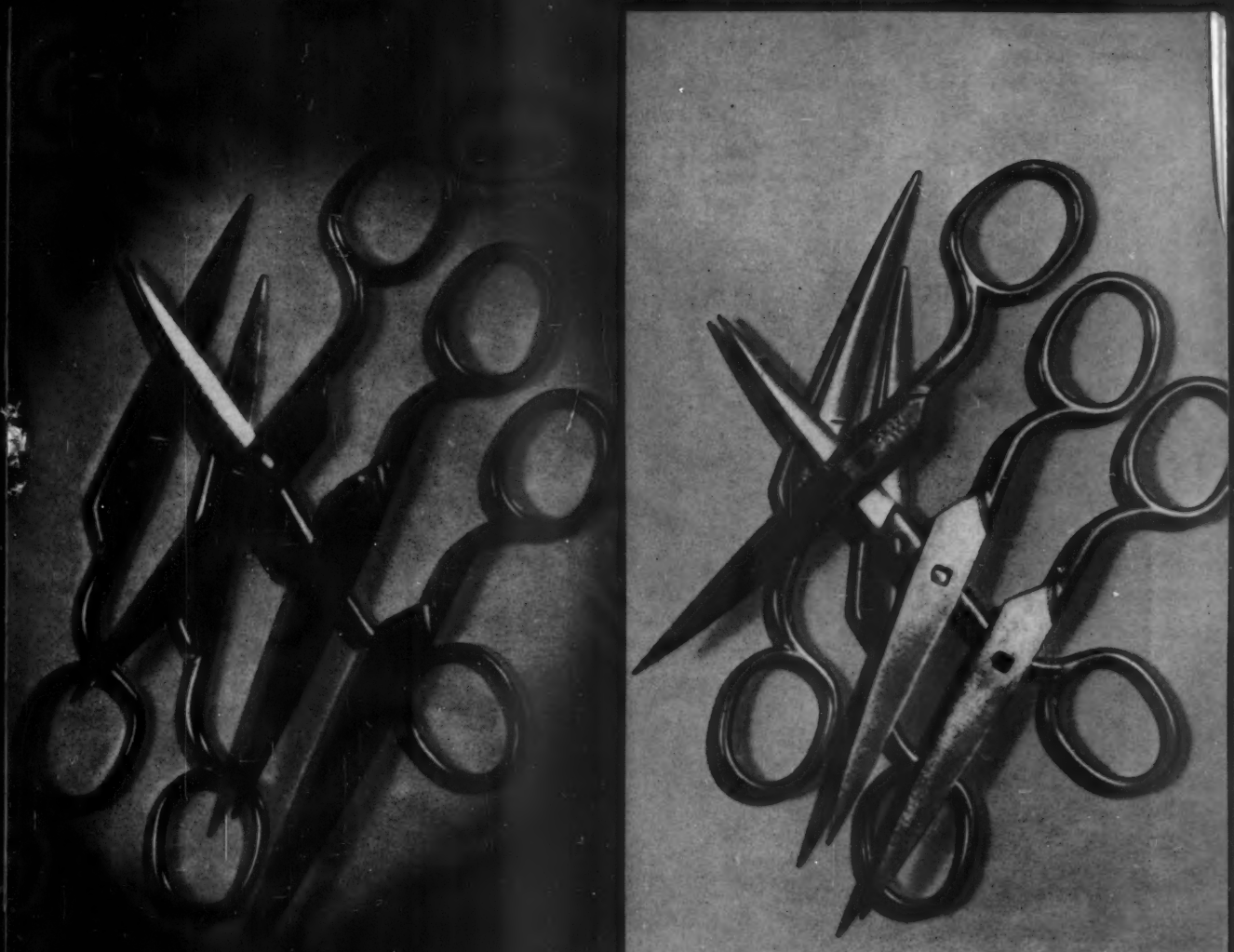
An experienced CLEPO metal finishing sales engineer works with you in each new application to insure top CLEPO performance.

Custom compounds for unusual requirements are developed in the Gumm research and testing laboratories.

Send for Bulletin 959

FREDERICK **GUMM** CHEMICAL COMPANY INC.

538 Forest Street, Kearny, N. J.



These Enstrip Metal Strippers work between shifts!

Nickel plated scissors on left were immersed overnight in an Enstrip A solution and left without supervision. Next morning (see right) they were down to bare steel ready for replating.

How would you like to dump your rejected plated parts into a stripping solution and "forget" them? Next morning, there they are, completely stripped and ready for replating! That's what Enstrip S and Enstrip A can do for you. These patented products of Enthonics research are alkaline solutions that dissolve nickel, copper, brass, silver, zinc and cadmium plate without attacking steel basis metals. Even when parts remain in the bath for hours after completion of stripping, the base metal remains as bright and shiny as it was prior to original plating.

Enstrip S and Enstrip A solutions operate at room temperature. No temperature, voltage or current to control. No electrical contacts to keep tight. Never any need to "rescue" the work upon completion of stripping. If you want rapid stripping, Enstrip S and Enstrip A solutions, operated at elevated temperatures, will dissolve .0015" of nickel or .0030" of copper per hour!

Write for the handy Enstrip Selection Chart which gives complete information about these new Enstrips, along with Enstrip 165 S (to dissolve nickel from copper and brass); Enstrip T-L (to dissolve soft solder, tin, and lead from steel and copper base alloys); Enstrip L-88 (to anodically remove copper, nickel, and chromium from zinc base die castings in a single operation), and many others. Enthone Incorporated, 442 Elm Street, New Haven, Connecticut.

ASARCO

ANOTHER PRODUCT OF Enthonics RESEARCH

ENTHONE

A Subsidiary of American Smelting and Refining Company

For the brightest electroplating

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

Three stages in finishing a zinc base die casting. Buffed part (center) is followed by electrocleaning in Oakite 195 (right). Hand holds plated part. Notice how electrocleaned part at right retains all the luster and color of the buffed part.

New Oakite electrocleaner assures brighter plate, fewer rejects for zinc die castings

It's non-etching and non-discoloring — that's why new electrocleaner Oakite 195 assures a brighter chromium luster, fewer plating rejects. Used with direct, reverse or periodic reverse current, it removes soils without dulling or darkening the buffed surface. It makes plating of zinc die castings a more dependable, more economical operation. Proof? Many users report *no* rejects due to poor electrocleaning *for the first time* in their experience.

Oakite 195 rinses easily, too, and has low foaming tendencies. Works well with copper and brass alloys, steel, lead and brittania metal, as well as zinc, making it ideal for service where several metals are cleaned in the same bath.

It's an excellent, profit-boosting material, but it's only *one* of a whole Oakite line. Ask the Oakite man to help you select the electrocleaner that gives you the brightest parts along with the brightest profit-picture. Or, write for Bulletin F-10466. Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

SCIENCE

50 *1909-1959 years' leadership in industrial cleaning*

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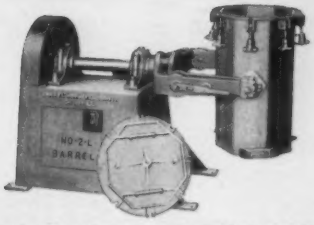
61 . . . for 61 years!

Manufacturing Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

Chas. F. L'Hommedieu & Sons Co.

No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 25 H.P. motors. Adopted by leading manufacturers as standard equipment.



TYPE L — DOUBLE ACTION BARREL
For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.

RELIANCE KUL-KUT BUFFS FOR FAST CUTTING

RELIANCE EXTRUDED COMPOSITIONS

STANDARD SIZE 2 x 2 x 10"

THEY CUT • THEY CLEAN • THEY COLOR

- **DURABILITY**
- **PRODUCTION**
- **ECONOMY**
- **EFFICIENCY**

THE ANSWER TO INCREASED PRODUCTION AT LOWER COST!

Manufacturers of Metal Finishing Equipment and Supplies

Chas. F. L'Hommedieu & Sons Co.

General Office and Factory
4521 Ogden Ave., Chicago 23, Illinois

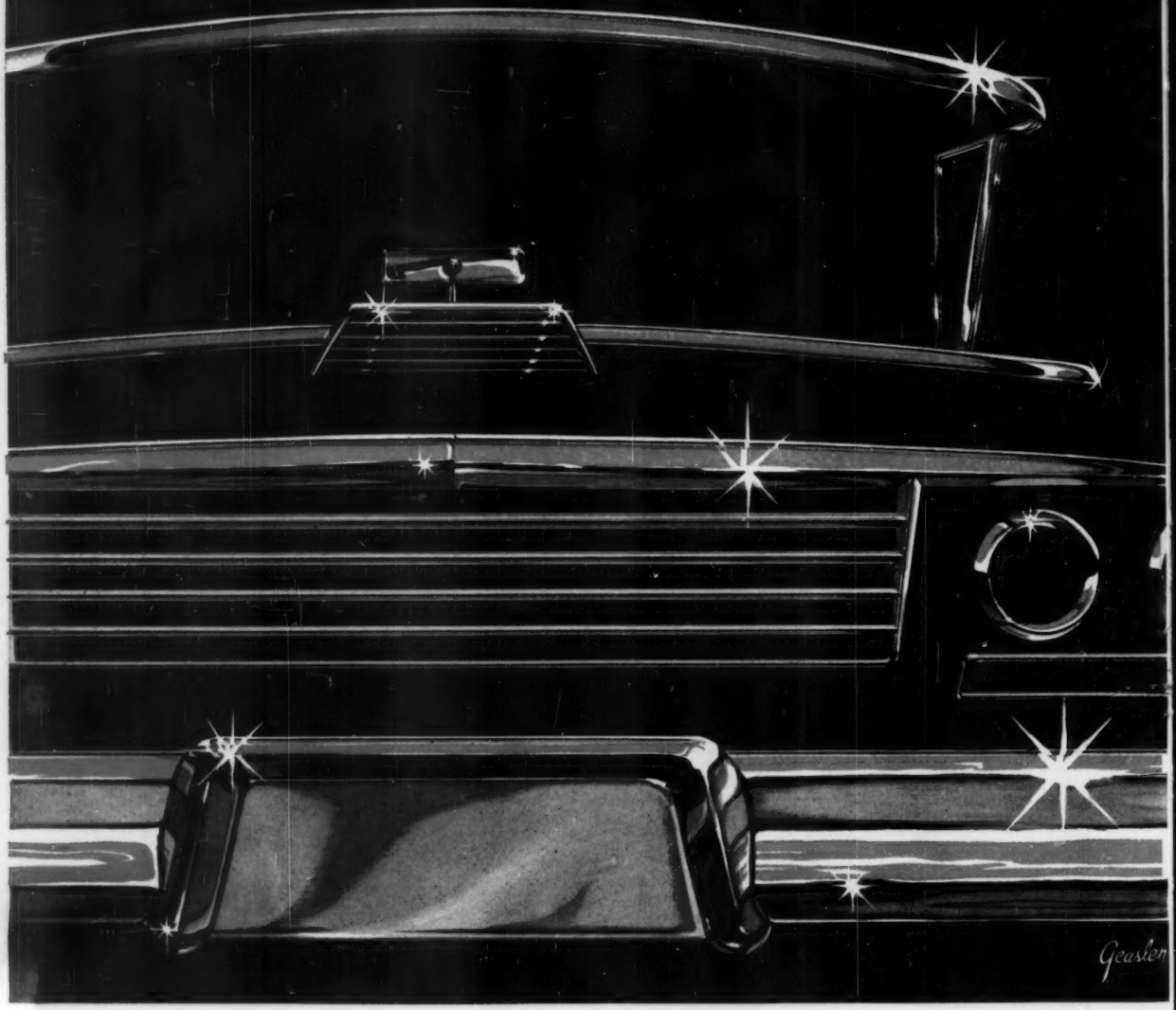
Chas. B. Little Co.
Newark, N. J.

W. R. Shields Co.
Detroit, Mich.

Branches:
Cleveland & Los Angeles

Harshaw Perflow-Perglow Duplex Nickel Plating Process
Continues to Make Startling Advances

now well over **one million**



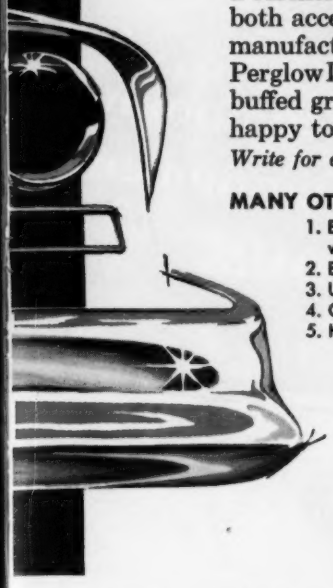
gallons *in operation*

There is no more graphic way to demonstrate the superiority of this outstanding Harshaw development than to *state the facts:*

1. *ALL* 1959 domestic autos used external parts plated with Harshaw Perflow-Perglow Duplex Nickel (*On some models as high as 90% of the external parts.*)
2. Over Three Hundred Thousand gallons of Perflow-Perglow Duplex Nickel were installed between June 15 and September 15, 1959!

This is an amazing growth record, pointing up the undeniable fact that automobile manufacturers and their suppliers turn to the process which promises maximum corrosion resistance for their products—and in an ever-increasing wave they are turning to the Harshaw Perflow-Perglow Duplex Nickel Plating Process.

The Harshaw Chemical Company after years of research and development work was the first to find that a *sulfur-free* nickel offers greater corrosion resistance. This fact led to the development of the Harshaw Perflow nickel plating process. Further research showed that use of the sulfur-free Perflow nickel deposit as a base coating, followed by a bright nickel deposit from a *compatible* bath, would give a Duplex deposit with a further improvement of corrosion resistance. Performance data, by both accelerated tests and outdoor exposure, from leading automobile manufacturers and parts suppliers indicate that the Harshaw Perflow-Perglow Duplex nickel plate is comparable to and frequently better than, buffed gray nickel and is unequalled by any bright nickel. We shall be happy to discuss this process with you in person, or by phone or letter. *Write for our free booklet, "Harshaw's Complete Service to The Plating Industry."*

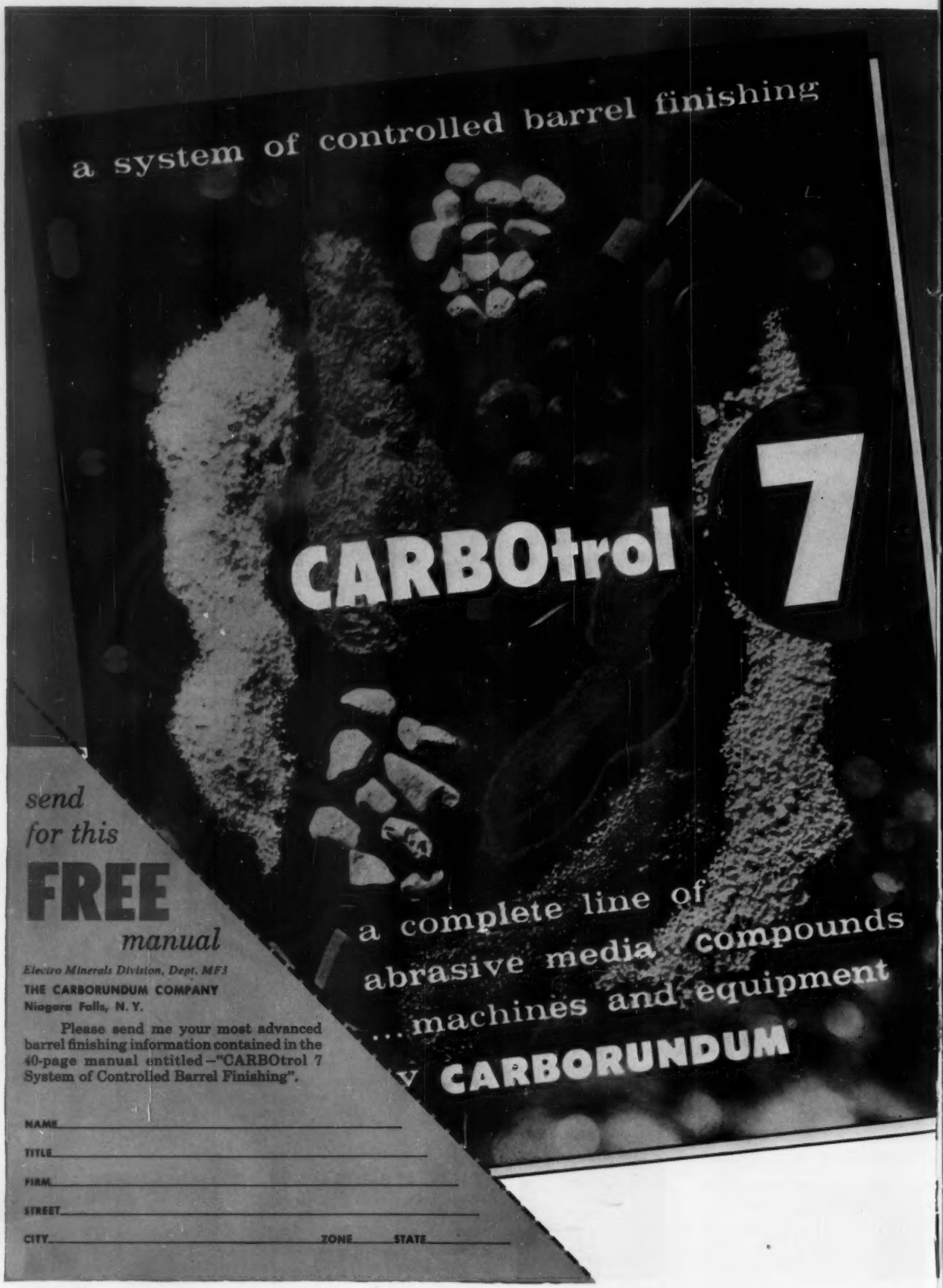


MANY OTHER ADVANTAGES

1. Exceptionally high plating speeds—with air or mechanical agitation.
2. Excellent Chrome Coverage.
3. Unsurpassed Leveling Characteristics.
4. Outstanding Brightness.
5. High Tolerance to Impurities.
6. Excellent Adhesion.
7. Excellent Ductility at Full Brightness.
8. Simplified Control—Stable over extended periods of operation.
9. Controlled Stress.
10. Uniform Protective and Decorative plate on both steel and zinc die castings.

THE HARSHAW CHEMICAL CO.
1945 EAST 97TH STREET • CLEVELAND 6, OHIO

Chicago • Cincinnati • Cleveland • Detroit • Los Angeles
Houston • Hastings-On-Hudson • Philadelphia • Pittsburgh


a system of controlled barrel finishing
CARBOtrol 7
a complete line of
abrasive media compounds
...machines and equipment
CARBORUNDUM
send
for this
FREE
manual
Electro Minerals Division, Dept. MF3
THE CARBORUNDUM COMPANY
Niagara Falls, N. Y.
Please send me your most advanced barrel finishing information contained in the 40-page manual entitled—"CARBOtrol 7 System of Controlled Barrel Finishing".
NAME
TITLE
FIRM
STREET
CITY ZONE STATE

the most advanced "know-how" in barrel finishing history

New **CARBORUNDUM** *Manual featuring the most complete source of technical data available anywhere*

CARBORUNDUM, a long established leader in abrasives, has now developed a new and exclusive method of controlled barrel finishing. Known as "CARBOtrol 7", this unique process assures low-cost metal finishing results.

In addition to a complete explanation of the "CARBOtrol 7" process, this manual includes comprehensive information on all types of abrasive media, barrel finishing compounds, and machines and equipment. Actual case history reports on a variety of applications, "do and dont's" of barrel finishing and a series of useful charts are also featured. These are but a few of the many interesting and instructive details of the "CARBOtrol 7" process contained in this manual.

Write for your copy today.

COMPLETE AND PROMPT SERVICE...*WHEN YOU NEED IT...WHERE YOU NEED IT*

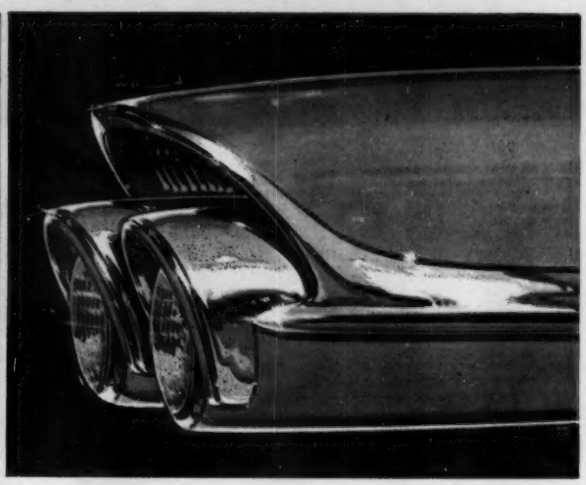
for expert advice . . . ask the man from

CARBORUNDUM®

M 60-911

Half a century apart . . .

both finished by Acme machines!

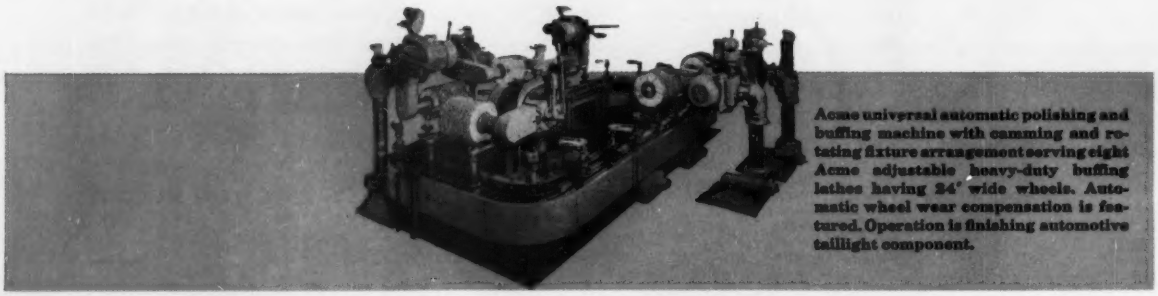


Even in 1910, part of an owner's pride in his car lay in gleaming brightwork. But polishing and buffing the shiny metal that he loved so well caused manufacturers plenty of headaches. And so they turned to Acme—and Acme has continued to supply the answers to their finishing problems.

Today, Acme engineers combine standard units with a variety of accessories to make custom polishing and buffing machines. Large corporations and small job shops alike use Acme machines to reduce rejects, increase production volume, machine finish odd-shaped pieces.

Every year of its history, Acme has encountered new finishing requirements—each an individual problem—and solved them. Chances are, we can solve your problem, too. Send for illustrated 16-page catalog today.

50 years of *Polishing Off* your finishing problems

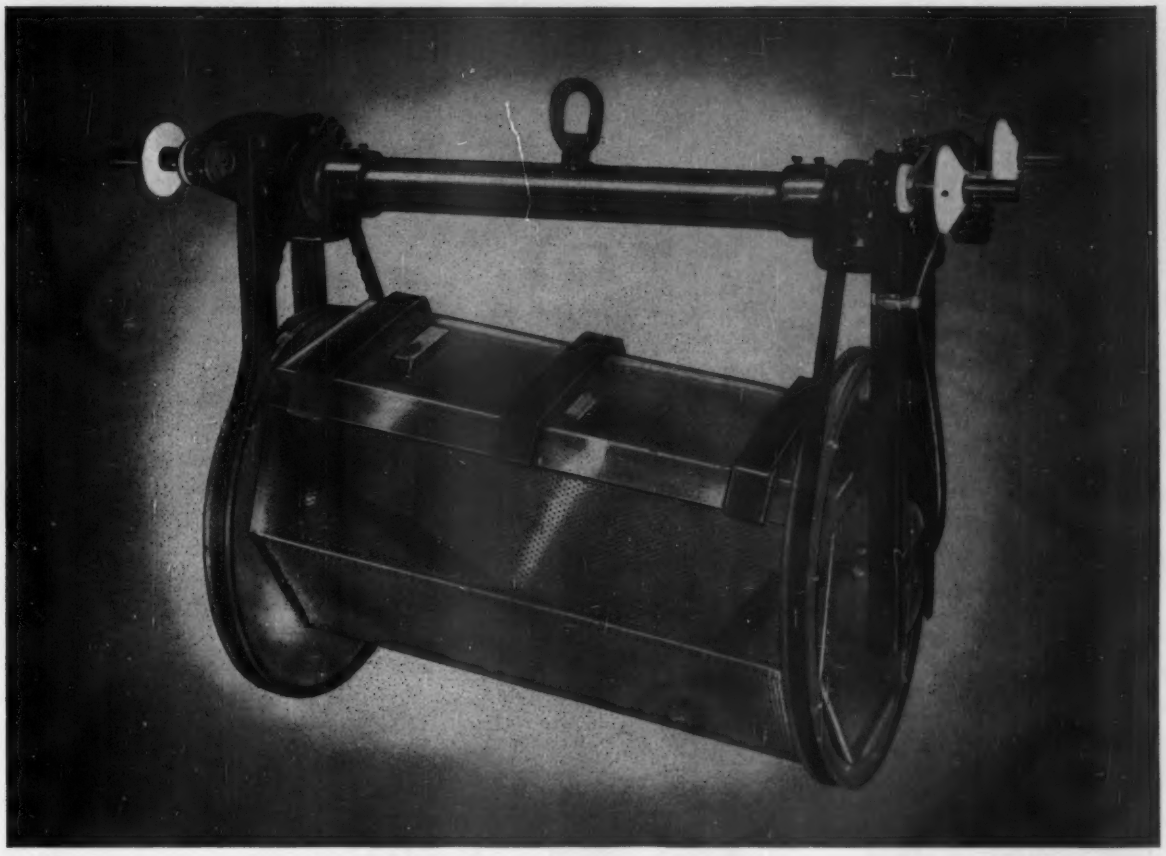


Acme universal automatic polishing and buffing machine with camming and rotating fixture arrangement serving eight Acme adjustable heavy-duty buffing lathes having 24" wide wheels. Automatic wheel wear compensation is featured. Operation is finishing automotive taillight component.

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910



Patent No. 2835664

Better Mixing *means Better Plating!*

LARGE
or small

BELKE Double Oscillating Cylinders are made in all sizes from 14x36 regulars to 6x12 portables.

Make sure your next plating barrels are Double Oscillating; enjoy *improved plating at a saving.*

That's the secret to the great and ever-expanding use of BELKE Double Oscillating Cylinders!

Ordinary cylinders just roll the work round and round; *Double Oscillating Cylinders add ROCK to the roll.* The work moves back and forth from end to end of the cylinder as it rolls round and round. Pieces move from the ends to the middle and from the middle to the ends. Buried pieces come to the top while others are buried. The pieces are turned in all possible positions; all surfaces are uniformly exposed to plating current.

This uniformity of exposure produces a specified plating thickness in less time, with less metal and with less current because you don't have to overplate most of the work to get the specified thickness on a small percentage of under-exposed surfaces.

You can count on Double Oscillating Cylinders for *improved plating at a saving.* On many hard-to-plate jobs the saving is terrific and EVERY PENNY YOU SAVE IS NET PROFIT because you add no expense.

GET THE FACTS! Send us your requirements for quotation.

Belke MANUFACTURING COMPANY
947 N. Cicero Ave., Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

Charlie Ott got what he wanted in a plating filter . . .

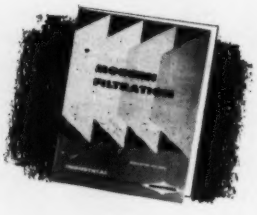
In 1929, C. F. Ott, now owner and president of Aircraft Plating and Polishing Company, grew impatient with breakdowns. He wanted a dependable, rugged plating filter. He got what he wanted—*in this early Type 111 Industrial filter.*

"Betsy's been in harness daily for over 30 years"

■ Thirty years ago, "Betsy" was one of only 9 sizes of the Type 111 filter. Today, this "Workhorse of the Industry" is available in *25 standard sizes.* Flow capacities range from 100 to over 30,000 gph. This growth in Type 111 *versatility* is typical of why and how Industrial has earned a position of leadership in the field of plating filters.

Industrial-Engineered systems traditionally give plating people what they want *for the job at hand* . . . highest possible performance potential at the lowest possible cost per gallon of filtrate.

It takes a wide range of models and sizes to meet these requirements—and *you'll* find what *you* want in the Industrial *Plating Bulletin.* Write for a copy.



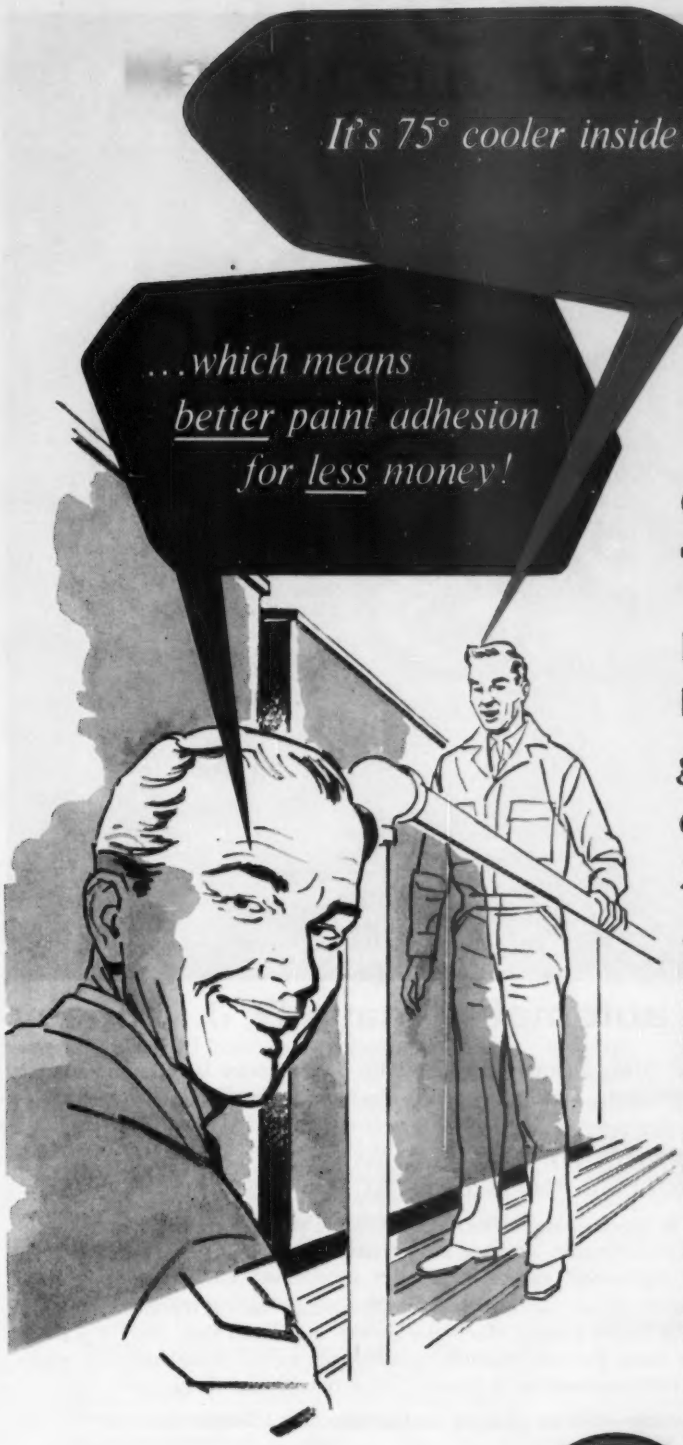
INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 Ogden Avenue • Cicero 50, Illinois

P-559

PRESSURE FILTERS ◆ ION & HEAT EXCHANGERS ◆ WASTE-TREATING EQUIPMENT



Only new

TURCOAT

LOW TEMP PHOSPHATING

gives you up to 200 mg/sq. ft. of zinc phosphate coating in 2 short minutes at 95° F.

The Turcoat low temperature phosphating process provides permanent paint adhesion when used at an economical, easy-to-maintain temperature of 95°F. This temperature is *lower* than that required by other "cold" phosphating processes. It is up to 75° *lower* than temperatures required by conventional phosphating processes. You save up to 75% in steam, water, electricity and downtime costs alone!

As a base for paint, the Turcoat low temp phosphating process provides a uniformly smooth coating of up to 200 mg/sq. ft. in two minutes at 95°F. **As a base for corrosion prevention,** it provides an 1100 mg/sq. ft. coating in just eight minutes at 95°F.

Turco has waited to announce low temperature phosphating until it was thoroughly perfected and proven, through exhaustive field testing, to be the very best. For this reason, you'll find that with this new process, just as with Turco's hundreds of other cleaning and chemical processes, you are assured of trouble-free operation, ease of control, and dedicated technical service...anytime, anywhere! Write today for the full story of Turcoat low temperature phosphating, along with Turco's phosphating reference chart. There's no cost . . . no obligation.

TURCO PRODUCTS, INC.

Chemical Processing Compounds

24600 South Main Street, Wilmington, California

FACTORIES: Newark, Chicago, Houston, Los Angeles, London, Rotterdam, Sydney, Mexico City, Paris, Hamburg, Montreal, Manila, Naha (Okinawa)

Manufactured in Canada by B. W. Deane & Co., Montreal

Offices in all Principal Cities

TURCO

TURCO PRODUCTS, INC.

24600 South Main Street, Wilmington, California

Please send full details on Turco's new low temperature phosphating process and Turco's phosphating reference chart, without cost or obligation.

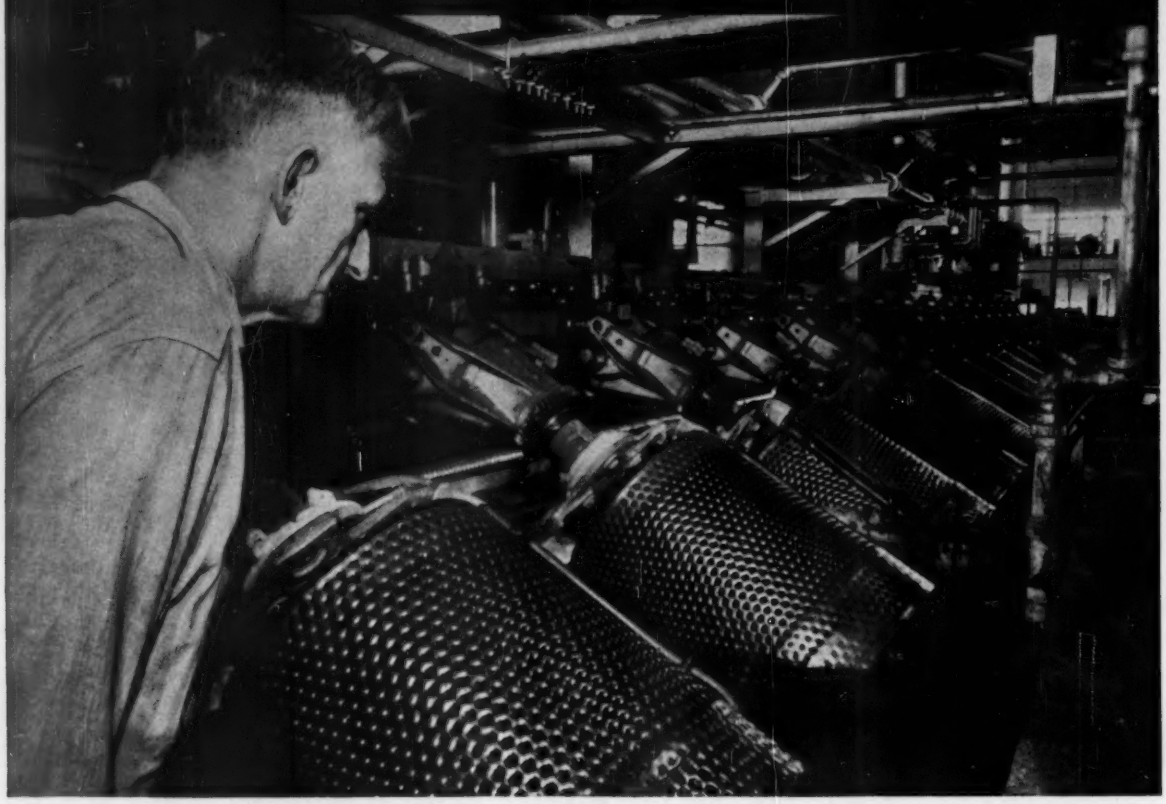
NAME_____ TITLE (OR DEPT.)_____

FIRM_____

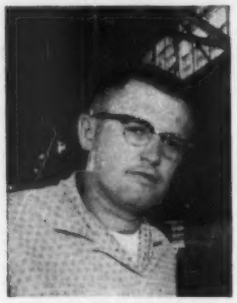
ADDRESS_____

ME

"THIS STEVENS BARREL PLATING MACHINE IS SAVING EATON THOUSANDS OF DOLLARS...



...and it's completely automatic!" says R. J. Munsey



R. J. Munsey
Division Industrial Engineer
Reliance Division
Eaton Mfg. Co.
Massillon, Ohio

A Stevens Automatic Barrel Plating Machine, with *one* operator is cadmium plating 1,750 pounds of lockwashers, Springtites, and Keps an hour for Eaton. It has also . . .

- INCREASED PRODUCTION 270%
- REDUCED REJECTS TO LESS THAN 1%
- REDUCED REQUIRED FLOOR SPACE BY 400 SQ. FT.

These savings, both in supplies and labor, mean volume production for Eaton Manufacturing Co. They've discovered, as have an increasing number of progressive companies, that Stevens equipment assures maximum production and superior quality.

Lower costs, consistent quality and assured production are only a *few* of the reasons why Stevens Automatic Barrel Plating Machines are the leaders in their field. For more details, contact your local Stevens Sales Representative today! Find out why more and more metal finishers are looking to Stevens for production savings.

Remember—When you go Automatic . . . go Stevens!

frederic b. **STEVENS,** inc.

DETROIT 16, MICH

BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN SPRINGFIELD (OHIO)

Safeguard overhead structures against corrosion with

TYGON® PROTECTIVE COATINGS

Have you checked your ceilings recently?

It pays to keep a sharp eye on the overhead structures in your plant, for corrosive fumes and gases can readily damage poorly protected walls, fixtures, ceilings, and other structural members. Unless detected in time, and corrective action taken promptly, such damage can be severe and costly.

So it's wise to make periodic inspections of those higher areas. And if you find "trouble spots" where present coatings are not giving adequate protection, Tygon Paint, with its exceptionally broad range of corrosion-resistant properties, is usually the recommended answer.

We don't claim that Tygon provides "universal" corrosion protection. Engineers know there is no "all-purpose" coating. But just about everywhere that protective coatings must withstand the effects of corrosive fumes and chemicals, specialized Tygon Coatings are meeting the challenge — providing longer service at lower long-term cost.

Send for this Tygon Data Book today. It contains complete application details plus helpful information on performance of Tygon Paint over a wide range of corrosives.

OUR 100th YEAR

PLASTICS AND SYNTHETICS DIVISION

U. S. STONEWARE

AKRON 9, OHIO

444-F

for mirror-bright gold and rhodium plating

ATOMEX® is a 24k gold immersion solution that permits the deposition of a thin, dense, uniform layer of 24k gold on such items as trophies, costume jewelry, lamp components, clock assemblies, photograph frames, bottle caps, radio knobs, metallized plastics and many other objects, by means of a simple bath. The Atomex procedure is more permanent and less expensive than electroplating of comparable thickness. Costly analytical control is unnecessary.

RHODIUM Plating Solution . . . is ideal for putting a decorative finish on many types of jewelry. It has a hard, brilliant white, non-tarnishable, highly reflective surface and is extremely resistant to corrosion. It gives greater sales appeal to any jewelry on which it is used. A complete line of Rhodium plating solution are available.

CHEMICAL DIVISION • 113 ASTOR STREET
NEWARK, N. J.

ROLLED FLAT PLATE ANODE SECTION: This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.

EXTRUDED ANODE SECTION: Note small, fully controlled regularity of grain size that promotes uniform corrosion, smoothest electrodeposits, less rejects.

these anodes are extruded and shaped to lower plating costs

These scientifically shaped anodes retain 80% of original active surface area after 85% by weight has been plated off!

Costs are lowered by prolonged anode life, minimized polarization and less silver scrap to be refined. In addition, the AP & S Extrusion Process controls grain size within definite ideal limits so that corrosion is smooth and uniform. Electro-deposits are consistently smooth. Shedding is virtually eliminated. Rejects are a comparative rarity!

We are anxious that the silver you buy in anodes is used most efficiently and economically. Special anode shapes will be engineered to meet your particular plating bath conditions. Call or write for a representative. We'll be glad to assist with your plating problems.

AMERICAN PLATINUM & SILVER DIVISION
231 N. J. RAILROAD AVENUE, NEWARK, N. J.

CHEMICAL DIVISION

ENGELHARD INDUSTRIES, INC.

EXECUTIVE OFFICES:

113 ASTOR STREET • NEWARK 2, NEW JERSEY

AMERICAN PLATINUM & SILVER DIVISION

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A DEVELOPMENT OF DIVERSEY RESEARCH

Diversey's new electrocleaning development can boost your output

. . . and reduce costs

This could be the electrocleaning improvement you've been waiting for. The combination of Diversey No. 15 SOAK CLEANER plus new Diversey No. 35 ELECTROCLEANER means increased production . . . and lower cost per part. You get absolute cleanliness with smut-free, waterbreak-free surfaces. The treatment results in more adherent plate . . . sharply reduced rejects . . . lower costs.

Here's the combination that is getting a new high in results on high-speed production lines:

Diversey No. 15 heavy duty soak cleaner. High speed removal of oily contamination • thorough emulsification • exceptional wetting action.

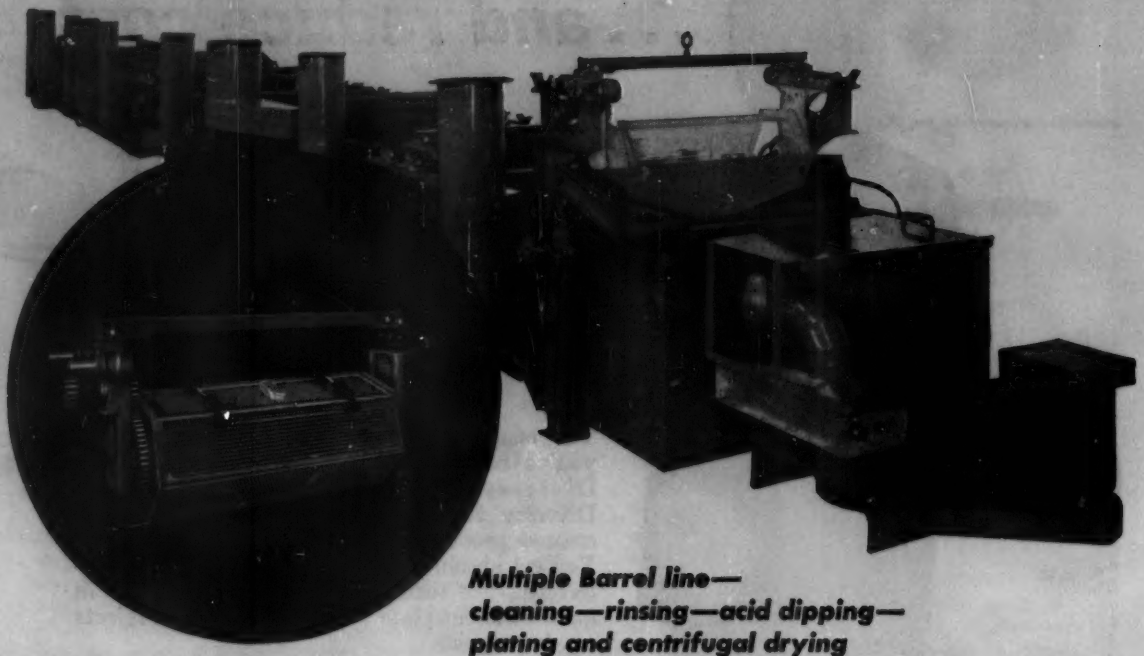
Diversey No. 35 high conductivity electrocleaner. Maximum conductivity . . . permits full loading of racks • produces waterbreak-free, smut-free surfaces, even in low current density areas.

Maintenance savings, too. Both cleaners deliver a new high in contamination tolerance for long solution life. And their advanced type water softening properties prevent hard precipitates from forming on tanks, reducing maintenance and down-time.

Get the facts now on the new cleaning combination that can give you better plating at less cost. See your Diversey D-Man or write Metal Industries Department, The Diversey Corporation, 1820 Roscoe Street, Chicago 13, Illinois.

DIVERSEY.

CROWN PLATING BARRELS



Multiple Barrel line—
cleaning—rinsing—acid dipping—
plating and centrifugal drying

CROWN LUCITE CYLINDERS

Can be operated through the entire cycle
cleaning—rinsing—acid dipping—and plating solutions.

Whether your production requires a single barrel
or a multiple set up for cleaning, rinsing, acid dipping, and
plating, there are Crown barrels to fit the job.

Write for complete details

CROWN RHEOSTAT AND SUPPLY COMPANY
1965 PRATT BOULEVARD • ELK GROVE VILLAGE, ILLINOIS

DOW | SARAN LINED PIPE

After 80,000,000 gallons of hot acid . . .

not a failure in 5,000 feet of Saran Lined Pipe

7,500 gallons per hour of hot acid solution . . . nearly two years of continuous trouble-free service with little maintenance . . . and there's never been a failure or replacement in the 5,000 feet of Saran Lined Pipe.

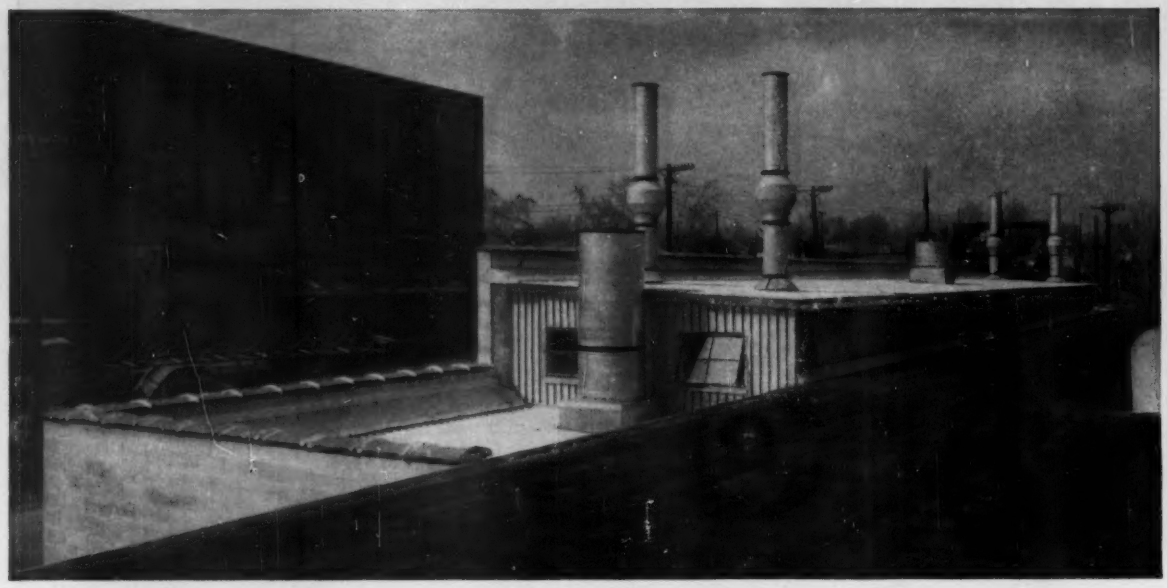
The above installation is a portion of the exclusively used Saran Lined Pipe which serves the plating plant of a leading automotive hardware manufacturer. This piping carries highly reactive copper and nickel plating solutions to plating machines, then returns them for filtering before reuse. Solution temperatures range from 105° F. to 150° F. Saran Lined Pipe is also used to connect plating tanks to heat exchangers, and as supply and return lines to solution storage tanks.

Plant engineering personnel state that the advantages they find in Saran Lined Pipe are ". . . corrosion resistance to the chemicals, ability to withstand temperatures of 150° F., strong and rigid enough to be installed without need of additional support."

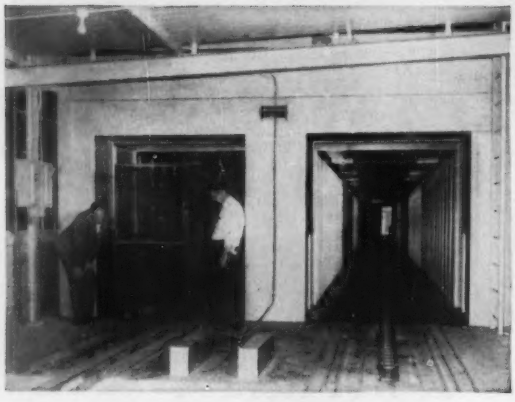
When plans call for piping systems that must resist corrosion and chemical activity, specify Saran Lined Pipe. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, and from below zero to 200° F. They can be cut, fitted and modified easily — right on the job. For more information write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 2501 CF11.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

FINISHING SYSTEMS...



Stout Sign Company Eliminates Production Bottleneck with Conveyorized Paint Baking Equipment!



In the two ovens above, installed at Stout Sign Company, St. Louis, Mo., uniform drying is accomplished by four recirculating zones in each oven. Hot air is forced across the oven by pressure and suction controlled by banks of narrow, vertical apertures in the oven walls which extend from floor to ceiling. These narrow apertures assure even distribution of hot recirculated air, and cause the air to flow horizontally through the sign racks and over the work. The direction of air flow is reversed in each successive zone. Air is recirculated at the rate of 13 oven volumes per minute.

Mahon engineers were called in to solve a paint-baking bottleneck in the production of metal signs painted with the silk screen process. This application process necessitates stacking freshly painted signs in a horizontal position, with only two inches of air space between, in specially built racks. Stout Signs had previously been baked in this manner in batch-type ovens.

The solution arrived at by Mahon engineers was two parallel tunnel-type, conveyorized ovens built as a single unit adjacent to the plant. Each oven was provided with independent temperature and conveyor speed controls and was designed to utilize existing sign drying racks which were modified and adapted to conveyor use.

The Stout Sign Company is now able to control temperature and time-length of the drying and baking process to meet any finish requirements . . . they are relieved of much manhandling of racks, and are free from excessive paint fumes and dust and lint troubles; production flows smoothly, and the quality of finish on their product is vastly improved.

The enthusiasm of a satisfied customer is best evidenced by the following excerpt from a letter recently received from Stout Sign Company: "Let me congratulate you and your entire engineering staff on an accomplishment beyond our expectations."

When you consider new finishing equipment or processing equipment of any type, you, too, will want to discuss your requirements with Mahon engineers.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York, Chicago, Los Angeles and San Francisco

Engineers and Manufacturers of Complete Conveyorized Finishing Systems: Metal Parts Washers, Metal Cleaning and Rust Proofing Machines, Conveyorized Cleaning and Pickling Machines; Dry-Off Ovens, Spray Booths, Electrostatic Spray Enclosures, Flow Coaters, Dip Coaters, Finish Baking Ovens, and Paint Stripping Equipment; Core Ovens, Soldering Ovens, Dehydrating Ovens, Heat Treating and Quenching Equipment for Aluminum and Magnesium; Dust and Fume Control Installations, and Many Other Units of Special Plant and Production Processing Equipment.

See Sweet's Plant Engineering File for Information and Representative Installations, or Write for Catalogue A-659

. . . the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!

MAHON

Yes, there's an answer to corrosion, after all

the udylite

Bi/NICKEL®

PROCESS

The combination nickel that's making plating history

only from **Bi/NICKEL** *do you get all these benefits*

1 SUPERB CORROSION RESISTANCE

Under actual exposure to highly corrosive atmospheres as well as accelerated CASS and Corrodkote tests Bi/NICKEL has proven its superiority over other bright nickel coatings.

2 THE MOST BEAUTIFUL FINISH

Color and brilliance obtained with Bi/NICKEL incorporating Udylite Bright Nickel, such as the Incomparable 66 and other Udylite nickel processes, cannot be matched.

3 ADHESION PROBLEMS LICKED

Bi/NICKEL offers a solution to adhesion problems previously considered inherent in combination nickel processes. Chrome finishes "take" to Bi/NICKEL with remarkable facility.

4 FULL RANGE OF COMBINATIONS

There is a version of Udylite's Bi/NICKEL which is adaptable to your product and problem whatever the demands of basis metal or the limitations of your already installed equipment.

5 INCREASED PRODUCT POTENTIAL

Here in Bi/NICKEL is a process that will immeasurably enhance the real value of the products to which it's applied. Longer life of usefulness and beauty can be expected from a Bi/NICKEL-Chromium finish. It gives you a real talking point when it comes to sales.

6 ANSWERS CUSTOMER COMPLAINTS

Bi/NICKEL is a step in the right direction toward solution of corrosion problems that have harassed automotive manufacturers and all others where corrosion has been a factor in a product's "life expectancy".

Discover TODAY how the Udylite Bi/NICKEL process is just what you've been looking for to meet and beat your corrosion problem.

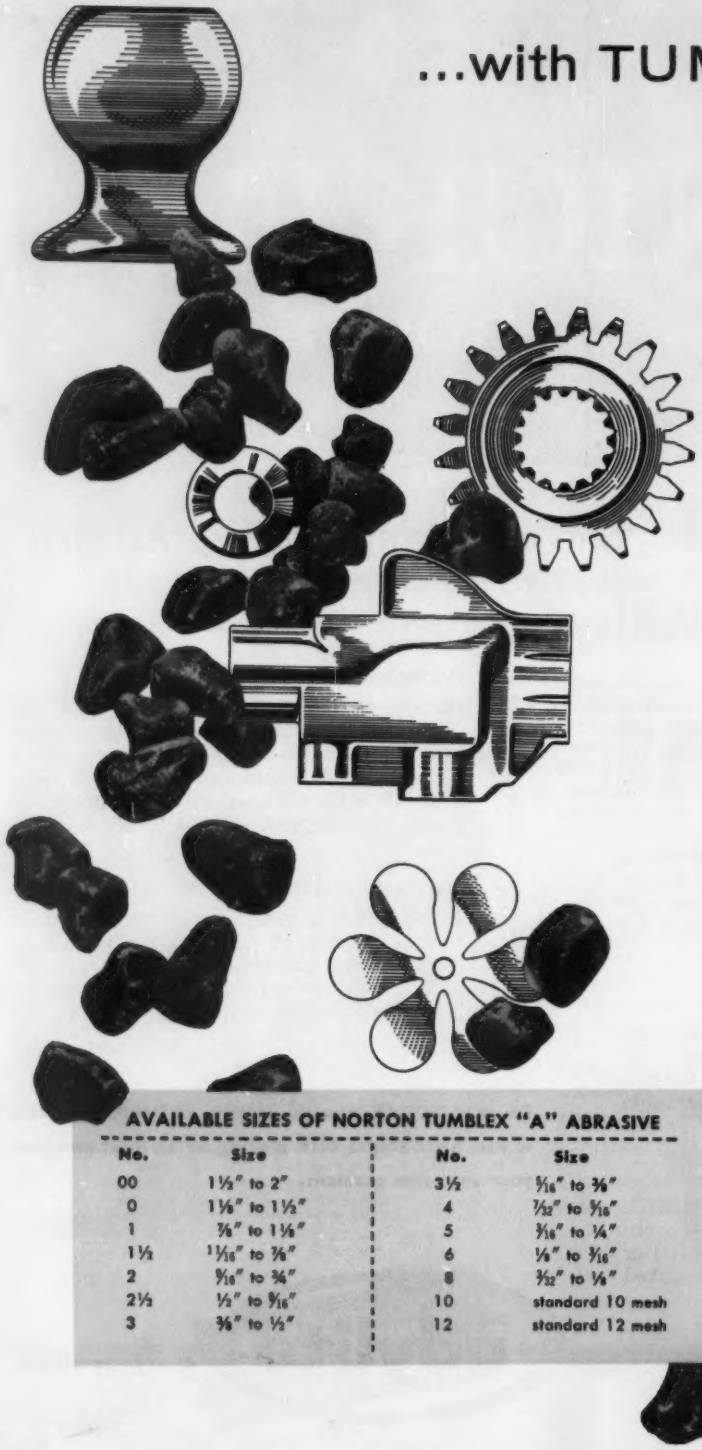
you get **Bi/NICKEL** *only from*

the udylite **corporation**

DETROIT 11, MICHIGAN
WORLD'S LARGEST PLATING SUPPLIER

Finish parts fast ... economically ... by the barrelful!

...with TUMBLEX* "A"



Norton TUMBLEX "A" abrasive gives barrel finishing the "Touch of Gold" advantages, the *fast* way to a *better* finish on your parts. This high production tumbling abrasive of Norton ALUNDUM* aluminum oxide forms radii and finishes to your required microinch reading while removing flash, scale, tool marks, and burrs at high production rates.

Available in a range of fourteen sizes, Norton TUMBLEX "A" abrasive is capable of providing excellent cut and finish on a *wide* variety of work pieces. It will not glaze, but instead will maintain a continuous high rate of cut.

Let our Sample Processing Department show you a better way of finishing. Send us unfinished samples and one finished piece. We will barrel finish samples with TUMBLEX "A" abrasive — or with one of the other Norton TUMBLEX abrasives if more suitable. Our return report will tell you exactly how you can improve product quality while cutting finishing time and costs. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

AVAILABLE SIZES OF NORTON TUMBLEX "A" ABRASIVE

No.	Size	No.	Size
00	1½" to 2"	3½	1/16" to 3/8"
0	1⅛" to 1½"	4	7/32" to 5/16"
1	⅞" to 1⅛"	5	3/16" to ¼"
1½	11/16" to ⅞"	6	⅛" to 3/16"
2	5/16" to ¾"	8	3/32" to ⅛"
2½	½" to 5/16"	10	standard 10 mesh
3	3/8" to ½"	12	standard 12 mesh

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

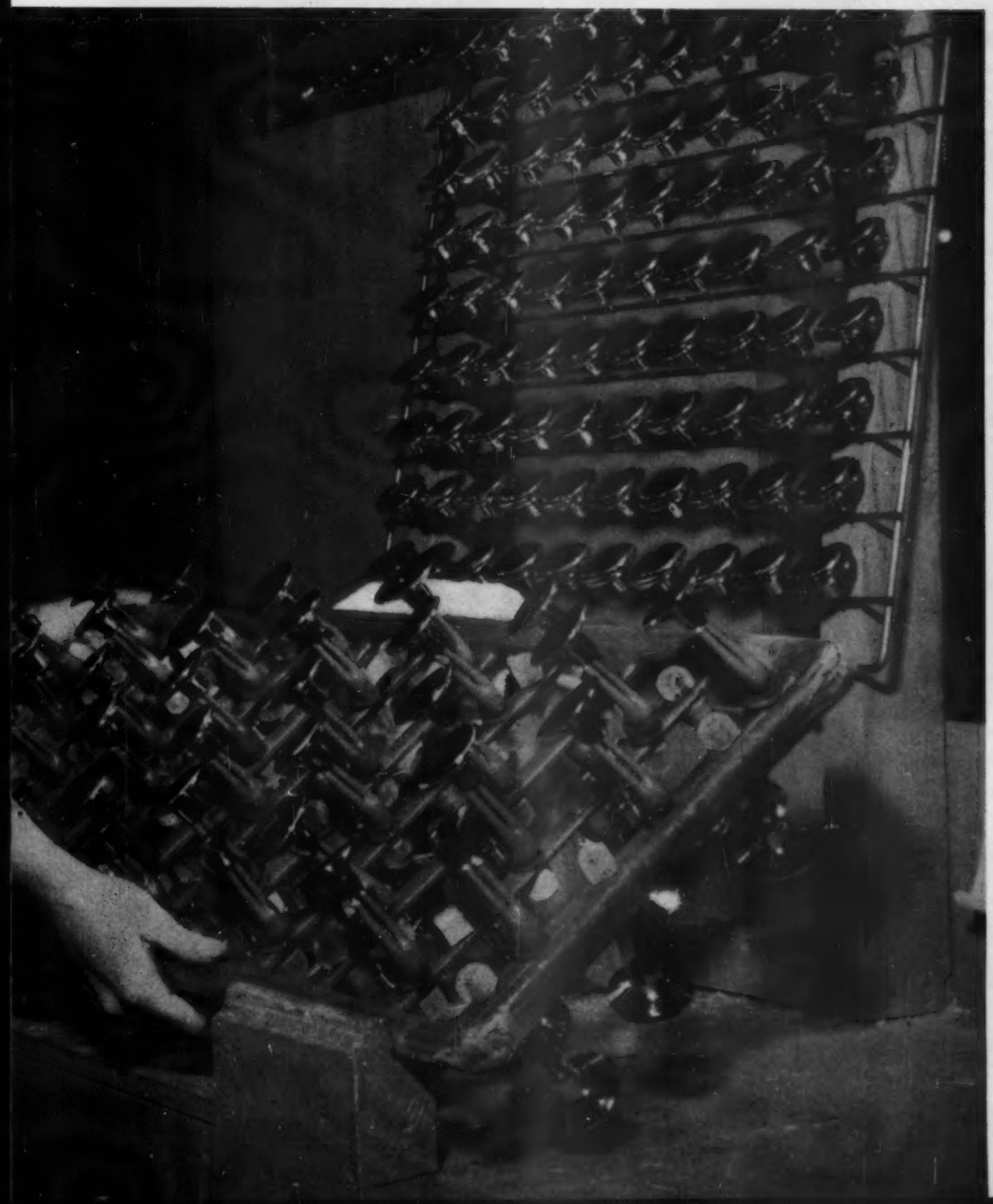
G-378

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Unique new brightener for zinc and cadmium plated parts **has been developed by Federated: CONMAX, a conversion coating for plated finishes from brilliant to iridescent, provides corrosion resistant film to zinc and cadmium plate. Other high quality, low-cost brighteners from Federated: ZIMAX for all types of zinc plating, still, automatic, and barrel; CADMAX for cadmium plating; NIMAX, highly concentrated brightener for nickel barrel plating. These brighteners undergo rigid competitive tests before approval for sale. This also applies to Federated's complete line of plating anodes and nickel salts. It's safest when you specify plating supplies from Federated Metals Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. In Canada, Federated Metals Canada, Ltd., Toronto and Montreal.**

FEDERATED METALS DIVISION OF

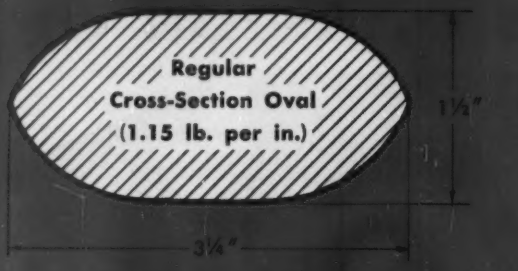


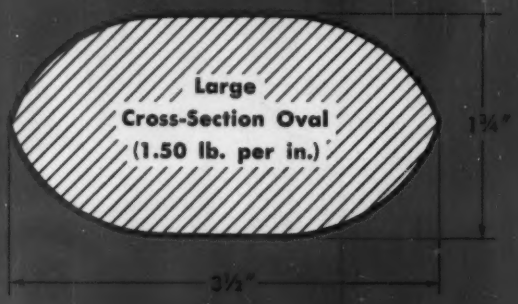
ASARCO

AMERICAN SMELTING AND REFINING COMPANY

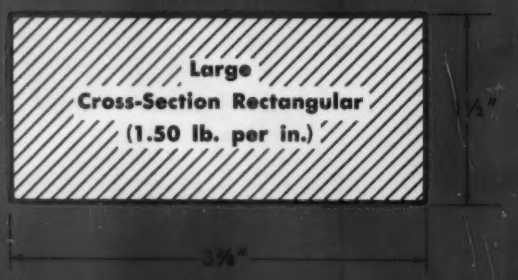
Besplate NICKEL ANODES..
large cross-section ovals and rectangulars

Oval Anodes





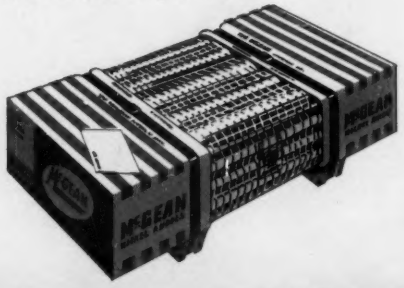
Rectangular Anodes



For the past 30 years, McGean Besplate Nickel Anodes have been produced in various shapes and sizes to meet customer requirements. The large cross-section anodes are 30% heavier than regular oval anodes and have the same identical composition. They are also 50% heavier than the standard Rolled Carbon Nickel Anodes.

Advantages . . .

1. Decrease in frequency of replacing anodes.
2. Substantial reduction in anode scrap per 1,000 pounds of nickel anodes consumed.
3. 30% to 50% cost reduction of anode bags.
4. McGean standard anode bags fit the large cross-section, rectangulars and ovals.
5. The large cross-section nickel anodes are chemically cleaned and packaged in the same fine manner as all McGean anodes.
6. The McGean foundry is equipped to process scrap nickel anodes into large cross-section ovals and rectangulars.



THE McGEAN CHEMICAL COMPANY

1040 MIDLAND BLDG. • CLEVELAND 15, OHIO

McGEAN

Branch Offices:
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LOOKING FOR A *Better* WAY?

MURRAY-WAY'S ROLLER COATERS

will SAVE you TIME, TROUBLE and MONEY on your Production Coating Requirements.

MODEL G top quality, heavy production coater. Vernier adjustments, hinged roll construction.

Compounds, waxes, sealers, rust-proofers, paints or varnishes — Murray-Way Roller-Coaters have handled them all . . . and handled them BETTER.

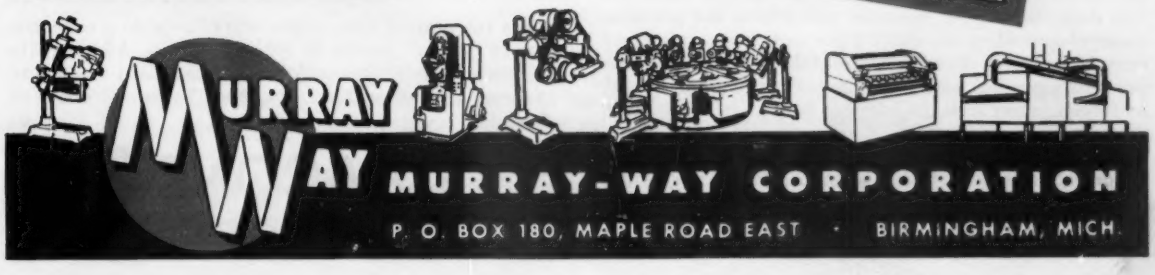
Specially engineered construction reduces or completely eliminates compound foaming and delivers accurate, even coatings under normal production line conditions hour after hour, day after day.

Unusually versatile, easily adjusted. Independent upper and lower roll drives. One or both sides coating. Simple, sturdy construction. Shielded bearings and drive mechanism and many other Murray-Way engineered features. Custom models built to your specifications.

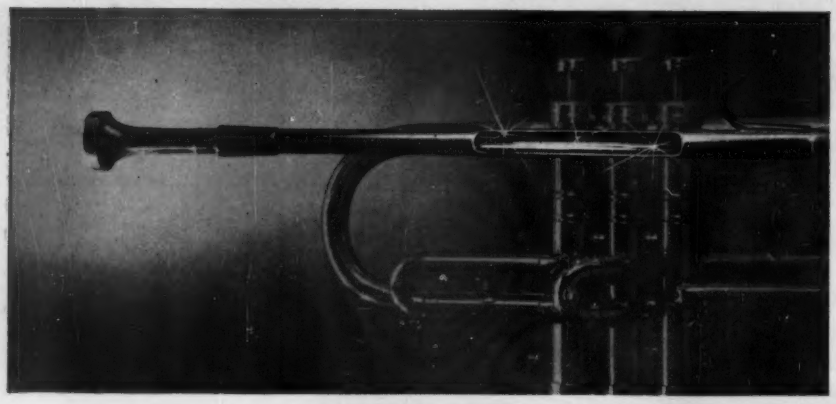
Write for detailed literature.

MODEL C budget priced, simple, sturdy. Ideal for automated lines. Conveyors optional.

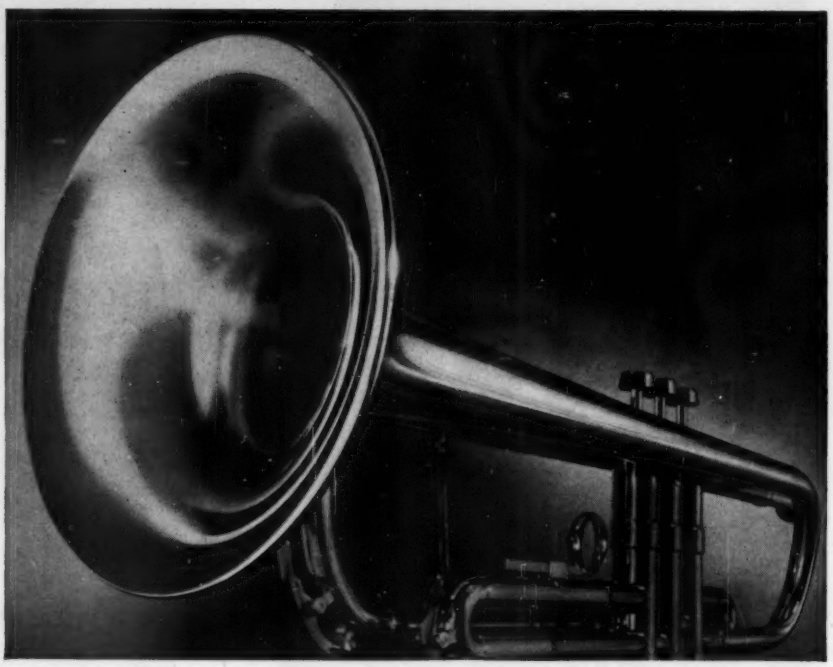
MURRAY WAY IDEAS
Murray-Way IDEAS from our engineering files.
Polishing head position indicator dials save time on work change-over—warn of tampering or variation.



Conn produces the "heart" of good tone quality by electrodeposition, with "Plus-4" Copper Anodes



CONN ELECTRO-D TONE CHAMBER (mouthpipe) cut away to illustrate the "micro finish" interior surface. Chamber and mouthpiece receptacle are formed in one piece by electrodeposition; previously the two pieces were soldered together. (Patent pending.)



ELECTRO-D BELL, also formed by electrodeposition.

In a cornet or trumpet, good tone and easy playing depend largely on the inside shape and finish of the tone chamber (mouthpipe).

Aiming at perfection, C. G. Conn, Ltd., famous maker of band instruments, turned to forming these critical parts by electrodeposition of copper on stainless-steel mandrels. The deposited copper conforms perfectly to the precision mandrel—providing the exact taper and dimensions every time. It also gives the smooth mirrorlike inside surface that prevents acoustical losses. Even minor irregularities caused by forming sheet metal or tube can muffle, distort, or rattle the tone.

Using "Plus-4" Phosphorized Copper Anodes in its acid-copper electroplating tanks, Conn has found it gets the smooth, dense deposit it needs. The build-up of metal is fast and uniform, as "Plus-4" Anodes' extra "throwing power" is of particular value with the tubular shapes. There are few nodules, which minimizes finishing of the outside surface. And tank maintenance is simplified.

Conn also forms the bells used in cornets, trumpets, and trombones electrolytically. This gives still further control in the precision of the entire inside tone columns of its instruments—for increased resonance and live, powerful tone.

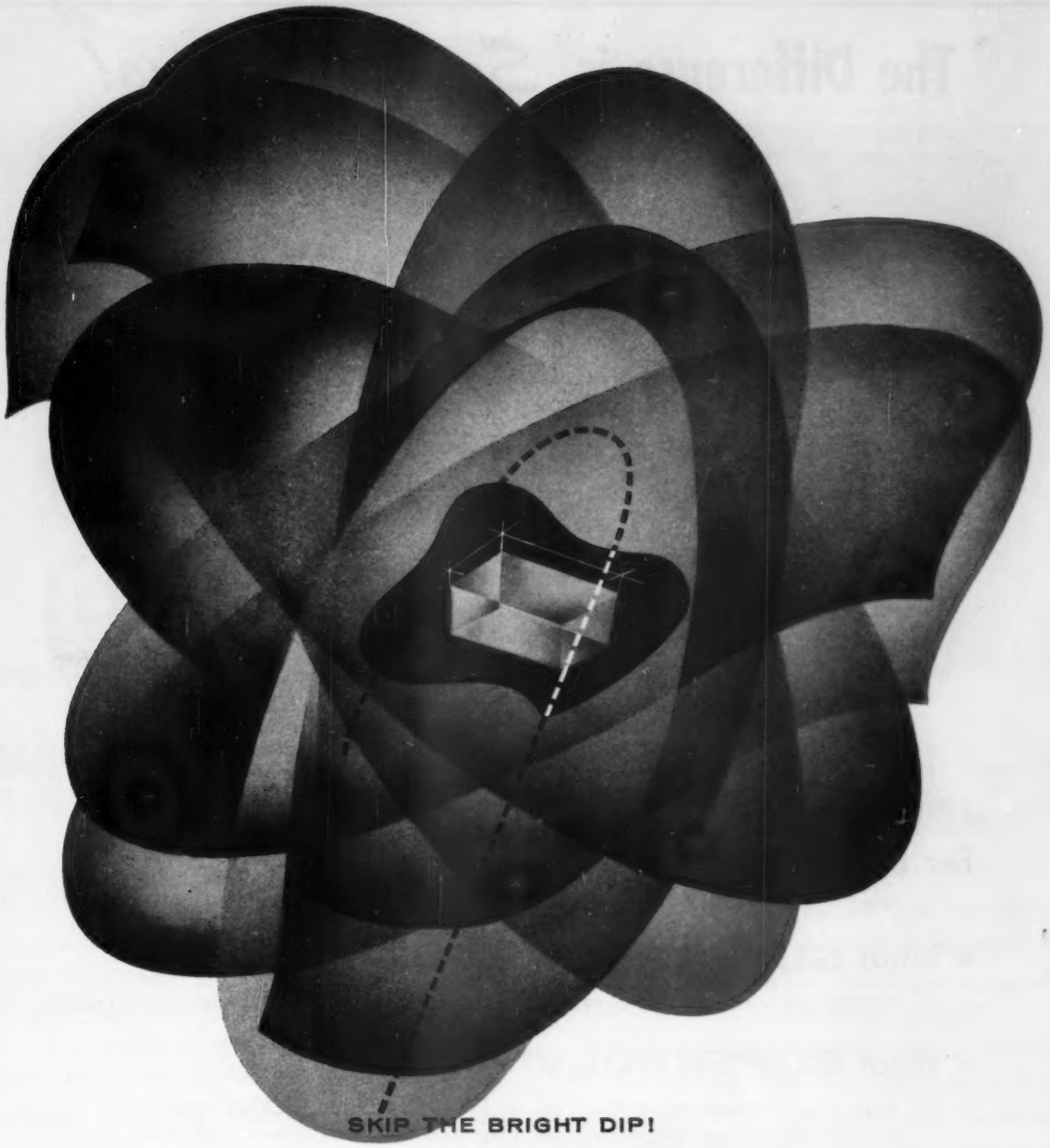
WRITE FOR INFORMATION on how you can obtain a test quantity of "Plus-4" Anodes to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Toronto 14, Ontario.

59108

ANACONDA®

"PLUS-4"® ANODES Phosphorized Copper

Made by The American Brass Company



SKIP THE BRIGHT DIP!

ZINCALUME* bright zinc process

Save a Step — Save a Buck. H-VW-M *Zincalume* makes a durable, uniform bright finish right in the plating bath — at lowest possible cost.

You can use *Zincalume* in a conventional cyanide zinc bath and obtain bright deposits with current densities from 10 to 80 asf.

Zincalume readily takes standard conversion coatings — works fine in still tank and barrel operations.

Want to know more about how *Zincalume* can save you money? Write today to:

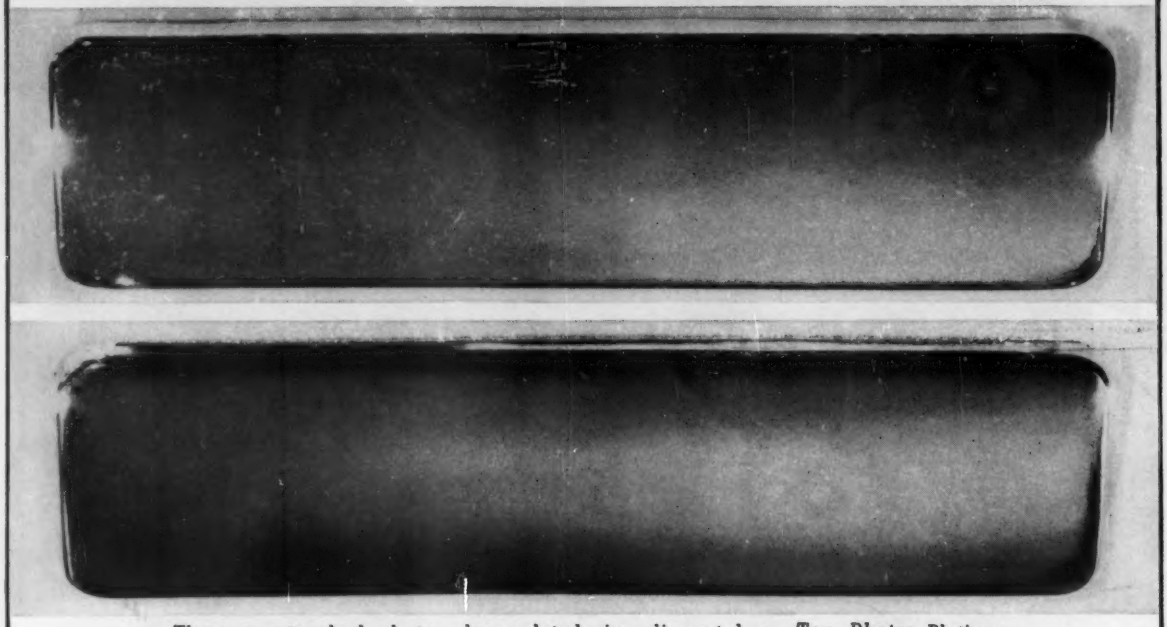
Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in Principal Cities.
Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

H-VW-M

Progress in metalfinishing through advanced processes • equipment.

*While a bright dip (we have a good one) will improve the luster and shelf life of any zinc finish, *Zincalume* looks fine right out of tank or barrel.

The Difference is *Soak Cleaning!*



These unretouched photos show plated zinc die-cast bars. *Top Photo:* Plating defects are visible on a bar precleaned with a conventional soak cleaner. *Bottom Photo:* Note the bright, lustrous, defect-free plate of the bar precleaned with Kelite SUPERSOLV as the soak cleaner.

For *bright, defect-free* die-cast plate . . .

Use Kelite SUPERSOLV as the Soak Cleaner prior to electrocleaning.

• What SUPERSOLV* is . . .

SUPERSOLV is a non-etch, non-passivating alkaline soak cleaner for zinc-base die-cast parts.

• What SUPERSOLV* does . . .

Used at a concentration of 5 oz./gal. at 160° to 170° F., SUPERSOLV removes mineral oils, buffing compositions and shop soils in a 1 to 2-minute soak cycle without sensitizing or staining the parts, or making them subject to roughness after electrocleaning and acid dip. The result is defect-free plate of improved brightness and lustre.

WRITE FOR PROCESS DETAILS ABOUT A TYPICAL ZINC-BASE DIE-CAST CLEANING CYCLE USING SUPERSOLV

*Patented, U. S. Patent Office

KELITE®

KELITE CORPORATION

LOS ANGELES 12 • CHICAGO 45 • BERKELEY HEIGHTS, N. J.

WHY EKCO CHOOSES MUTUAL CHROMIC ACID FOR ITS "ARMORIZED" CHROME FINISH

Ekco Products Company knows that quality chrome plating gives products permanent brilliance. That's why Ekco uses Mutual® Chromic Acid to plate their Autoyre line of bath, kitchen and closet accessories. Careful control, plating skill plus Mutual Chromic Acid help achieve Ekco's patented Armorized* Chrome-12*, a top quality chrome finish which sells merchandise.

Mutual Chromic Acid is always 99.75% pure—or better. Its low sulfate content (less than 0.1%) makes it easier for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

To learn more about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions.

*Trade Marks owned by Ekco Products Company

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate ■ SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide ■ SOLVAY Methylene Chloride

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

SOLVAY PROCESS DIVISION 9-119
ALLIED CHEMICAL CORPORATION
61 Broadway, New York 6, N. Y.

☐ Send Bulletin 52, "Chromium Chemicals"
☐ Have a representative phone for appointment

Name_____
Position_____
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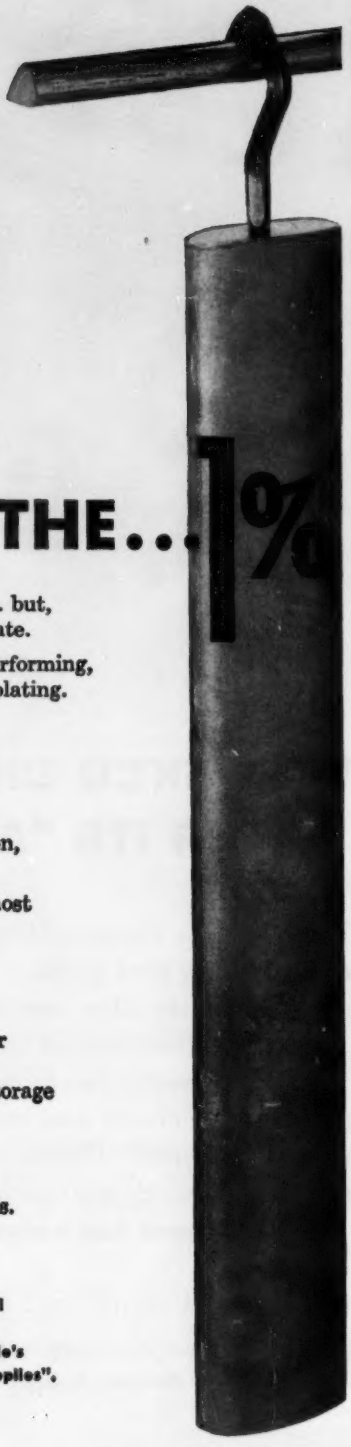
LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY



BUYING 99+% NICKEL?

Here's why you should

CHECK WHAT'S IN THE...1%

Of course, you, as a nickel user, want 99% pure nickel anodes . . . but, it's that 1% that makes the difference between good and bad plate.

At Allied Research, we make sure that 1% gives you a better performing, more economical anode, for fast, smooth, low-cost and efficient plating.

Here's how:

1. **All our nickel anodes are cast from 100% electrolytic nickel—free from harmful contaminates.**
2. **Carbon and silicon are carefully added to assure you of even, constant corrosion rate and faster, smoother plating.**
3. **Copper and iron are kept to a minimum—well below the most rigid specifications—eliminating excessive brightener consumption, down time or rejects.**

NEW ALLIED RESEARCH ANODE PAK

Sturdy, corrugated cartons keep your anodes clean, uncontaminated—ready to use. Paks make handling, storage and inventory easier, too.

NICKEL RECASTING SERVICE

Your nickel butts and spears recast under the same rigid controls. For really substantial savings, get details on our Nickel Recast Blanket Purchase Plan.

For full information on Allied Research Nickel Anodes, Anode Pak or our Nickel Recasting Service, contact your Allied Field Engineer. He's listed in the yellow pages under "Plating Supplies". Or, write for FREE TECHNICAL DATA FILES.

Allied Research Products, Inc. 4004-06 EAST MONUMENT STREET • BALTIMORE 5, MARYLAND
BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butcher Co.

Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment, and Supplies for Metal Finishing

IRIDITE® Chromate Coatings | IRILAC® Clear Coatings | ISOBRITE® Plating Brighteners | ARP® Chemicals & Supplies | WAGNER Line of Equipment

WORLD'S BEST WAY TO CLEAN METAL!

It's the Acoustica ultrasonic way! The metal is immersed in a cleaning solution, activated in an Acoustica ultrasonic tank. Almost instantaneously, the fluid bubbles with powerful "cavitational" action. *"Silent sound" is at work!* In seconds the dirt has disappeared—every particle of it, down to the invisible dust that escapes the human eye. *It has been blasted away ultrasonically!* There is no laborious, time-consuming scrubbing, no disassembling—maintenance costs are at a minimum. Results are better, faster, cheaper. Definitely the world's best way to clean metal is the Acoustica ultrasonic way!

Acoustica is the recognized leader in quality ultrasonic cleaning equipment, the sole producer of the *Multipower* transducer. An Acoustica *certified* ultrasonic application is your assurance of maximum cleaning efficiency!

Acoustica Associates, Inc., Fairchild Court, Plainview, N. Y., 10402 Aviation Blvd., Los Angeles, Calif.

acoustica

THE GREATEST NAME IN ULTRASONICS

Excelsior catches *dress up* prized possessions

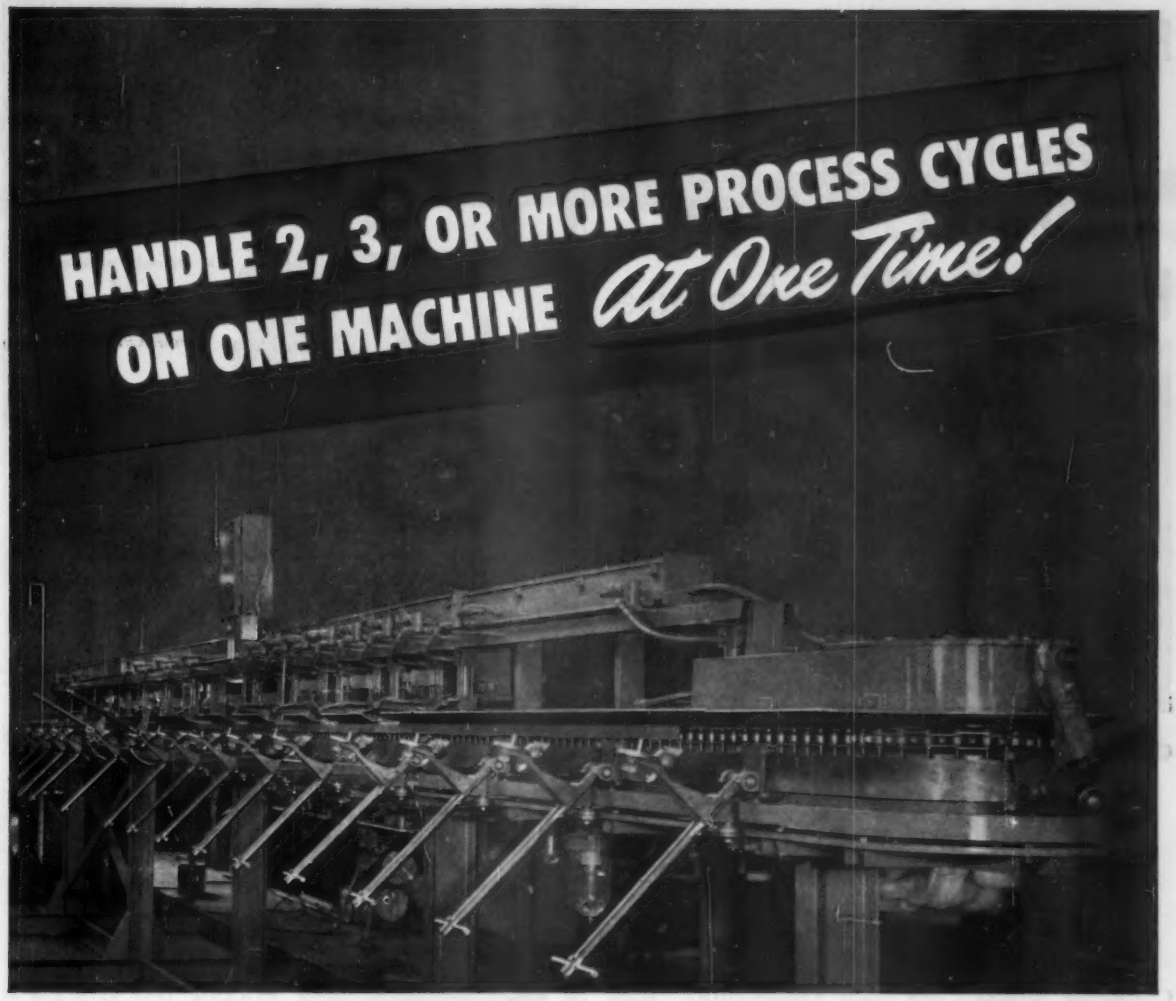
. . . AHCO Compounds produce their lustre

These modern catches are the two latest additions to the Excelsior Hardware Company's family of enclosures. On luggage, on carrying cases, wherever a durable, attractive enclosure is called for, Excelsior enclosures are helping to close sales. One of their secrets is their long-lasting lustre — and the Ahco Burnishing Compounds that produced it. Excelsior Hardware gets the right results because their Ahco Compounds are custom-formulated for their specific application. The same could be said of so many other manufacturers with a metal finishing operation to perform. Incidentally, have you discussed your application with an Ahco Field Engineer? Write us today at 28 Benedict Street, Waterbury, Conn.

Hubbard Hall

THE
HUBBARD-HALL CHEMICAL
COMPANY
APOTHECARIES HALL DIVISION

THE GREATEST NAME IN ULTRASONICS



LASALCO'S *Select-O-Matic*

MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in *fully automatic* plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack *automatically* travels through the entire selected cycle without further attention.

A single Select-O-Matic plater, manned by one operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

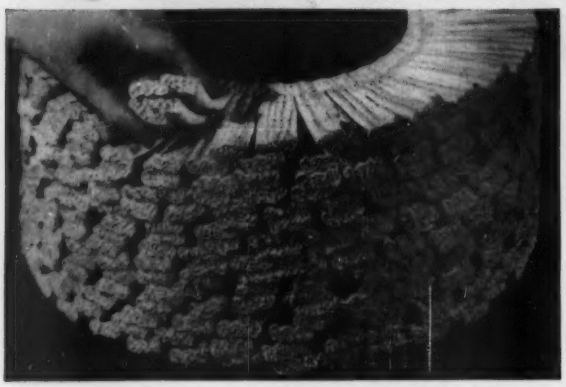
The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

Write Today!

LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
IN TEXAS: 2805 Allen Street • Dallas, Texas • Riverside 7-5814

Finishing Room Superintendents specify the Churchill 20-RD Sisal Finger-Buff*... because



only the Churchill 20-RD produces a uniform high quality finish

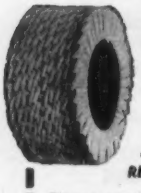
PLUS

FASTER CUTTING action!
LONGER WEARING qualities!
REMARKABLY smoother finish!
UNEQUALED FLEXIBILITY in a sisal buff!

Churchill 20-RD Cord Sisal Finger-Buffs* produce exceptional results on stainless. They are competitively priced and made in all sizes from 3" to 21" diameters.

Write for complete information.

**The trade's attention is called to United States Patent No. 2,724,937, issued Nov. 29, 1955, to George R. Churchill relating to the cloth-covered cord wheel exclusively manufactured by Geo. R. Churchill Co., Inc. of Hingham, Mass. and marketed under its trade-mark, "Finger-Buffs", Reg. U. S. Pat. Off.*



Geo. R. Churchill Co., INC.
The Original **FINGER BUFFS***
(*T.M. Reg. U.S. Pat. Off.)
Hingham Mass. Dept. MF-119

FREE Catalog

REPRESENTATIVES IN PRINCIPAL CITIES

Please send me FREE catalog of Churchill Finger Buffs.

Name ..... Title .....

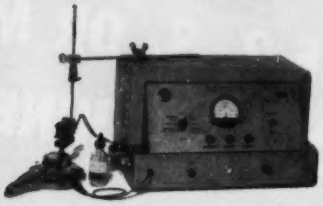
Firm .....

Street .....

City ..... Zone..... State .....

• My special buffing problem is.....

Thickness Testing . . . Analysis, and pH made simple with KOCOUR TEST EQUIPMENT



- direct reading
- virtually automatic
- 90-95% accurate
- simple operation

Test composite coatings . . .

CHROMIUM-NICKEL-COPPER

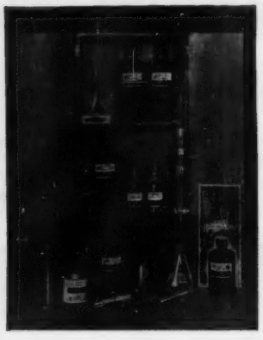
Individual thickness readings

No need to use approximations or lengthy chemical methods to determine composite coating thickness. Model 955 determines the thickness of each layer with separate readings of actual thickness for each coating. This is one of the many applications of the Kocour Electronic Thickness Tester. Operation is simple and automatic . . . 90-95% accurate . . . direct readings. Write for Bulletin 400.

Control your plating solutions regularly with

KOCOUR TEST SETS

Regular control is not only convenient, but you save time . . . avoids delays and shut down, and prevent trouble, KOCOUR TEST SETS provide the best and most direct methods of control. They are complete . . . simple to use . . . no knowledge of chemistry required . . . calculations are minimized.



Whatever your needs . . . KOCOUR TEST SETS are available individually or in economical combinations for the control of plating, cleaning, pickling, anodizing, sealing, coating, passivating, desmutting, deburring, phosphorizing, heat treating, pH control and thickness testing. Write for your FREE copy of "Lab Hints for the Plater."

● KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.
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KOCOUR COMPANY
4802 S. ST. LOUIS AVENUE
CHICAGO 32, ILLINOIS

Specify KOCOUR test sets from your supplier.

LEA

ABRASIVE FINISHING METHODS

COPPER

STAMPINGS · CASTINGS · EXTRUSIONS

The softness of copper necessitates special methods and abrasives in finishing the surface. This metal is generally considered to flow readily during polishing and buffing operations and for this reason copper plate finds extensive application as an undercoat for nickel plate. Minor scratches and depressions in the base metal surface are filled with metal in this manner. General methods for the finishing of copper plate will be covered in a later Methods Sheet.

FLEXIBLE POLISHING... Removal of spinning marks, pits, small defects, etc., is usually done by flexible polishing with Grade "C" LEA COMPOUND on a loose muslin buff at about 6000 sfm.

SATIN FINISHING... This final finish is usually produced with Grade "C" or Grade "A" LEA COMPOUND on loose muslin buffs, ventilated or bias buffs, string or wick wheels. Buffs operating at 4500-6000 sfm will produce a fine satin finish on copper.

BRIGHT FINISHING... When a bright finish is required on solid copper articles made by casting or extrusion, the following procedure is typical:

1. Flexible polishing with Grade "C" LEA COMPOUND on a muslin buff with ⅜" spiral sewing at 5000 sfm.
2. Cut-down buffing with Grade 765 LEAROK or LIQUABRADE Grade TH62M, on a pocketed or ventilated buff at 7000 sfm.
3. Cut and color buffing with Grade 155 LEAROK or LIQUABRADE Grade UH20C on a full-disc, loose or pocketed buff at 7000 sfm.
4. Color buffing with Grade 309 LEAROK or LIQUABRADE Grade UH20A on a loose muslin buff at 6000 to 7000 sfm.

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

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Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

Tailored cyanide copper processes

...there's a specific Lea-Ronal copper process to meet your own exacting requirements

Over the years Lea-Ronal has gained world-wide recognition for its research on cyanide copper plating. From this research and development have come numerous processes, each with its own characteristics that make it outstanding for a specific type of operation. Every member of this Lea-Ronal family of Cyanide Copper Processes has been thoroughly production-tested and has been instrumental in improving the quality and production of the user's plating operation.

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THROUGH WHOM THESE CYANIDE COPPER PROCESSES ARE EXCLUSIVELY MARKETED.

The LEA GROUP
serving the Finishing Field
Lea-Ronal, Inc., Jamaica, N. Y.
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for bright high speed copper

COPPER-GLO

For plating buffed zinc die castings or steel where maximum leveling or hiding is not a factor.

A full bright high speed cyanide copper that has become the industry standard. Through continued research this process has been constantly improved to give trouble free bright high speed operation.

for buffable copper

CUPRALL

A lustrous, ductile, buffable copper than can be plated at high speeds. Because of these characteristics and its exceptional tolerance to impurities, this bath has become the standard for such operations as bumper refinishing.

for hiding imperfections

Q-STRIKE

A cyanide copper strike developed to aid in "hiding" surface imperfections that are not covered by conventional strikes or bright copper processes. Will increase hiding and leveling when used as a strike prior to bright nickel.

for micro-leveling and lustre

Q-LEVEL

A new improved economical and simple cyanide copper process that offers a definite degree of leveling or hiding without employing current reversal cycles. Imperfections in castings can be partially or completely hidden (Leveling is achieved on surface roughness not exceeding 10 RMS).

for high rates of deposition plus micro-leveling

AIR-Q-LEVEL

A Q-Level Bath specifically designed for air agitation. Offers all the advantages of the Q-Level Process plus increased rates of deposition, and excellent metal distribution.

for leveling plus high rates of deposition

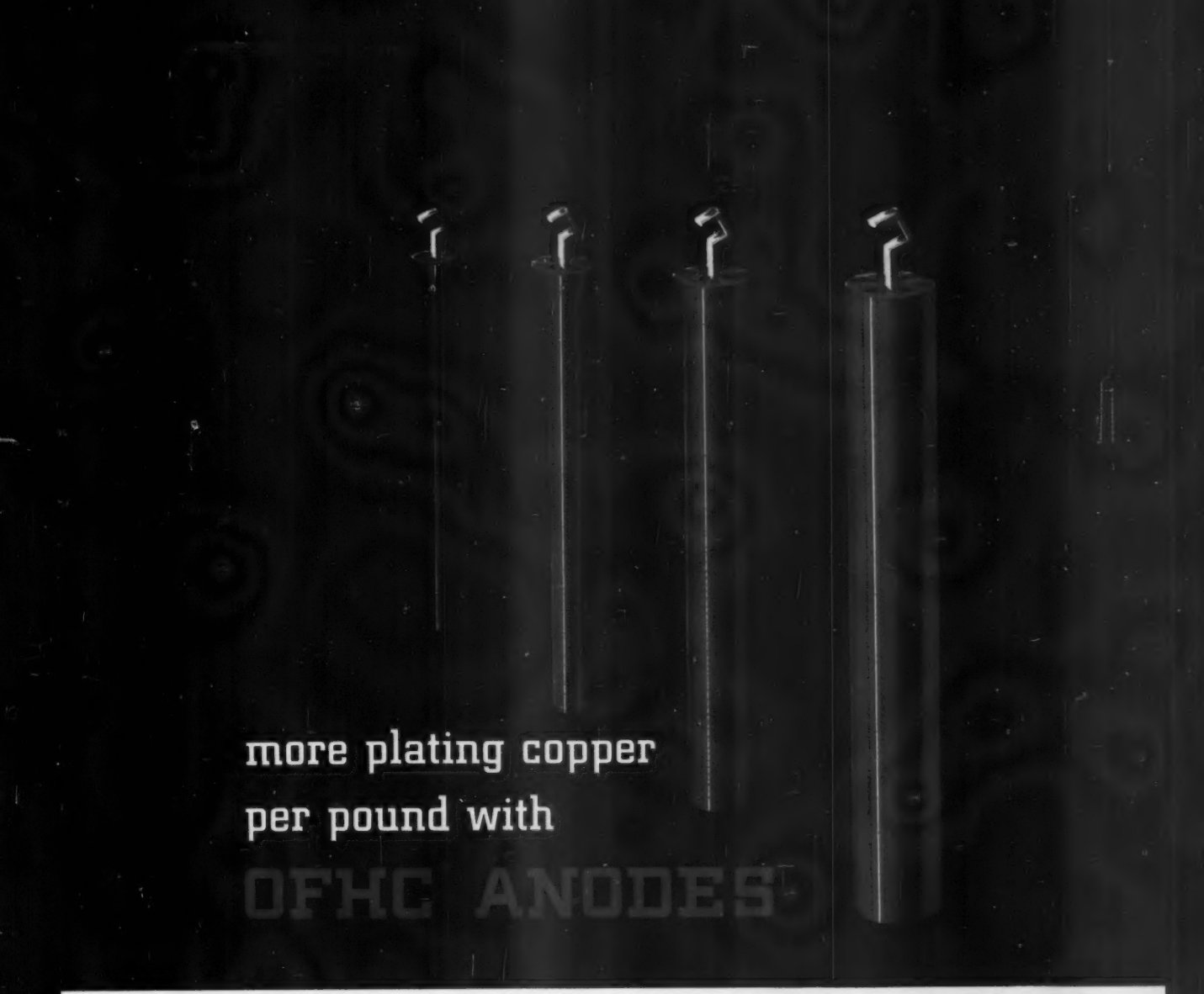
PR-Q-LEVEL

A Q-Level Bath designed to operate with Periodic Reverse. In addition to the high rates of deposition, macro-leveling as well as micro-leveling can be achieved. Process is simple, economical, completely stable with no deterioration of brighteners over prolonged operating periods.

Any order for a Lea-Ronal Process carries with it plus values in experienced technical service and know-how.

Note: The above Lea-Ronal Cyanide Copper Processes are covered by patents or pending patents.

Are you interested in Buffing, Polishing and Burring Specialties? **SEE OTHER SIDE OF THIS INSERT.**



more plating copper per pound with OFHC ANODES

An ever-increasing number of platers are discovering that use of OFHC Anodes reduces anode consumption for a given amount of coverage and thickness. The reason: OFHC Anodes are the purest copper anodes produced— 99.99+% copper, completely free of oxides, and uncontaminated by residual deoxidants. Their density is equal to that of rolled anodes. Purity and density add up to *more usable plating copper per pound of anode.*

In addition, OFHC Anodes dissolve uniformly, right up to the solution level. This of course cuts scrap loss, means less down-time for scrap removal and anode replacement.

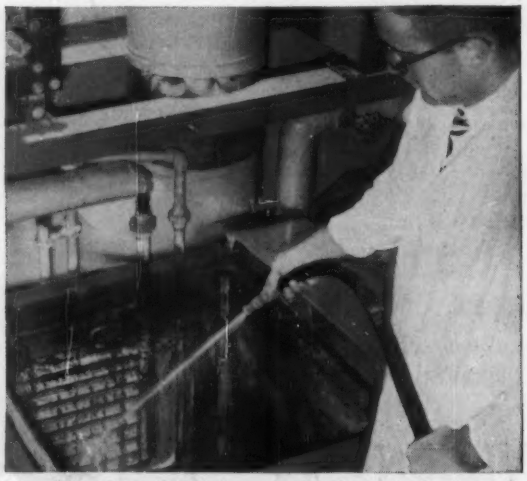
Free technical publications to help you obtain better plating — and at the same time lower costs—are available from your OFHC Anode distributor, or directly from AMCO Technical Service Section. Ask for them today.

AMCO DIVISION
American Metal Climax, Inc.
61 Broadway, New York 6, N.Y.

OFHC Anodes—Made Only by American Metal Climax—are Sold by Leading Plating-Supply Distributors Everywhere.

Here's an aluminum ...reduces maintenance costs... ...MIL-

Ordinary caustic solution causes build-up of scale on tank interior. Scale must be chipped off frequently.



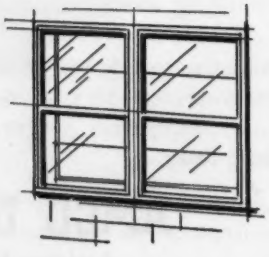
New Wyandotte Mil-Etch suspends dissolved aluminum in solution. No scale develops throughout entire life cycle.

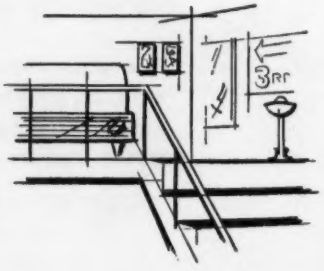
Here's a brand-new caustic-type aluminum etchant that eliminates expensive shutdowns, needless maintenance and labor costs. Mil-Etch keeps dissolved aluminum in solution—prevents it from forming a hard scale that must be chipped from tank walls.

Etches rapidly and uniformly. Economically concentrated, Wyandotte Mil-Etch produces an attractive, uniform, high-quality etch in only a few minutes on aluminum extrusions, wrought sheets and bar stock. You can also use Mil-Etch for deep etching or chemical milling of aluminum alloys.

Easy to use. Mil-Etch is nondusty, will not cake

Use Mil-Etch for





etchant that eliminates scale produces a bright matte surface

ETCH!

in drums; also, no excessive foam or fumes. You can use a tank of Mil-Etch until it becomes "loaded" with dissolved aluminum. Tank dumping is simple – just pull the plug!

Desmutting. For brightening aluminum alloys that turn dark in alkaline etching processes, try Wyandotte 2487. It is safer than ordinary acid solutions, and permits a closer control of the desmutting bath. Being in easy-to-handle granular form, solution make-up and additions are simple.

For full information on how new Mil-Etch and Wyandotte 2487 will solve your aluminum-etching problems, call your Wyandotte representative.

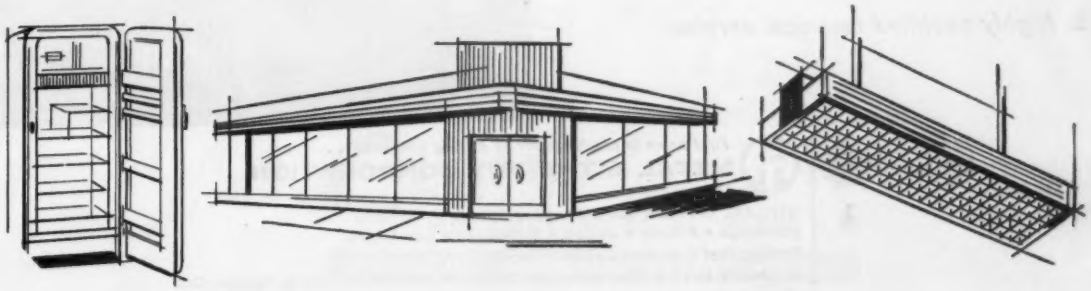
Wyandotte Chemicals Corporation, Wyandotte, Mich.
Also Los Nietos, Calif. Offices in principal cities.

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

Wyandotte
CHEMICALS

J. B. FORD DIVISION

etching all aluminum surfaces



NEVER ANY BATH CONTAMINATION

from Unichrome Coating 218X . . . one more of its advantages

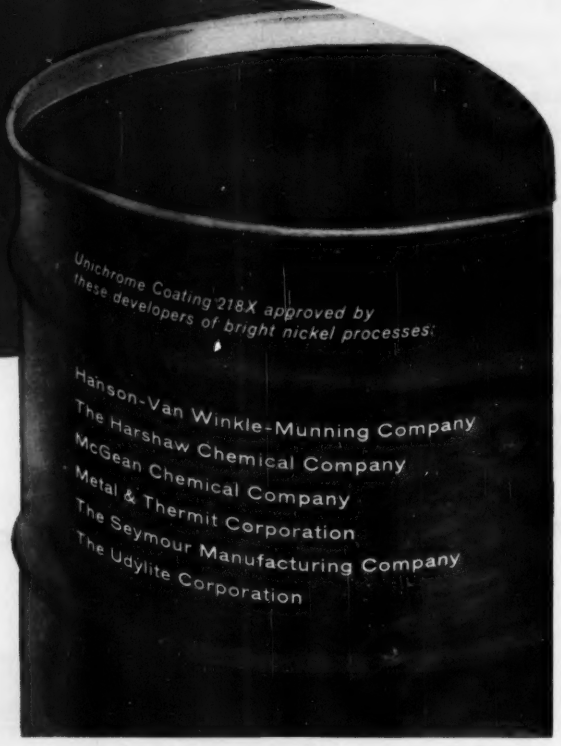
It's unanimous . . . racks insulated with completely inert Unichrome Coating 218X are fit to work in any bath without causing contamination. Nothing leaches out of this top quality vinyl plastisol in plating or anodizing solutions. *Especially significant is its approval by leading developers of bright nickel solutions.*

And because Coating 218X won't chip, tear or blister . . . retaining its slick, free-rinsing surface . . . it helps to control contamination from drag-in as well.

Along with this performance goes phenomenally long life. Economy-wise platers have had long experience with Coating 218X . . . some up to 10 years overall. All agree that *using the best quality at the outset saves most money in the long run.*

Are you benefiting by the coating that stands out on all five major counts? Send for details.

Are you using the rack coating that gives you ALL FIVE?


Unichrome Coating 218X approved by these developers of bright nickel processes:
Hanson-Van Winkle-Munning Company
The Harshaw Chemical Company
McGean Chemical Company
Metal & Thermit Corporation
The Seymour Manufacturing Company
The Udylite Corporation

1. *Built-in cure indicator assures maximum performance*
2. *No contamination of plating baths*
3. *Ability to be rebaked for patching*
4. *Nationwide set-up of expert applicators*
5. *Highly qualified technical service.*

UNICHROME

First name in plastisols for all plating purposes . . .

METAL & THERMIT CORPORATION

GENERAL OFFICES: RAHWAY, NEW JERSEY
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Member, Vinyl Dispersions Division of the SPI
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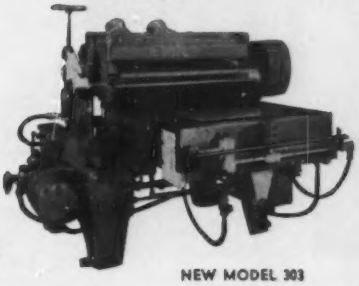
CLAIR SURFACE FINISHING MACHINES

Must be OUTSTANDING!

THE NEW 303 IS

Versatile

Available in four sizes -- with many optional features. Work held either mechanically or by vacuum.



NEW MODEL 303

✔METALS
✔PLASTICS
✔WOODS

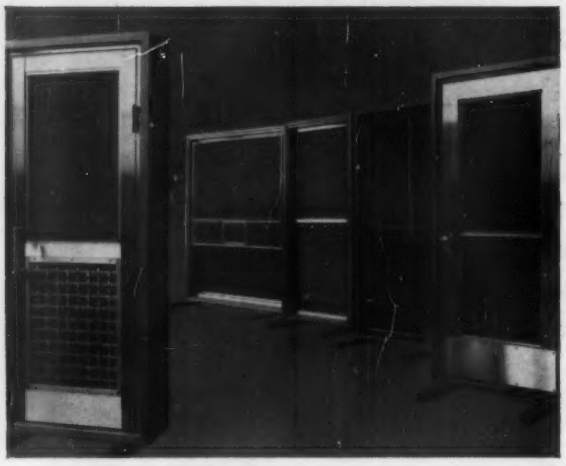
New single roll table type in four sizes. Hydraulic travel: in, out and sidewise. Delicate automatic counter-balancing assures sensitive floating action for flat or contoured surfaces. Quick-Change spindle. Max. floor space: 6' - 10" wide x 10' - 7" deep. Wt. approx. 6,000 lbs. Model 303 can be shipped assembled. Let us know YOUR requirements.

The Clair #303 is but one of ten different models which are available.

HOW ELSE COULD YOU EXPLAIN THAT 95 REPEAT CUSTOMERS HAVE PURCHASED A TOTAL OF 664 SINCE 1947 ?

CLAIR
MANUFACTURING CO., Inc., OLEAN, N.Y.
Offering the Most VERSATILE Line of Surface Finishing Machines

Columbia-Southern's Technical Service Department helped Kane cut their degreasing solvent needs by 30%



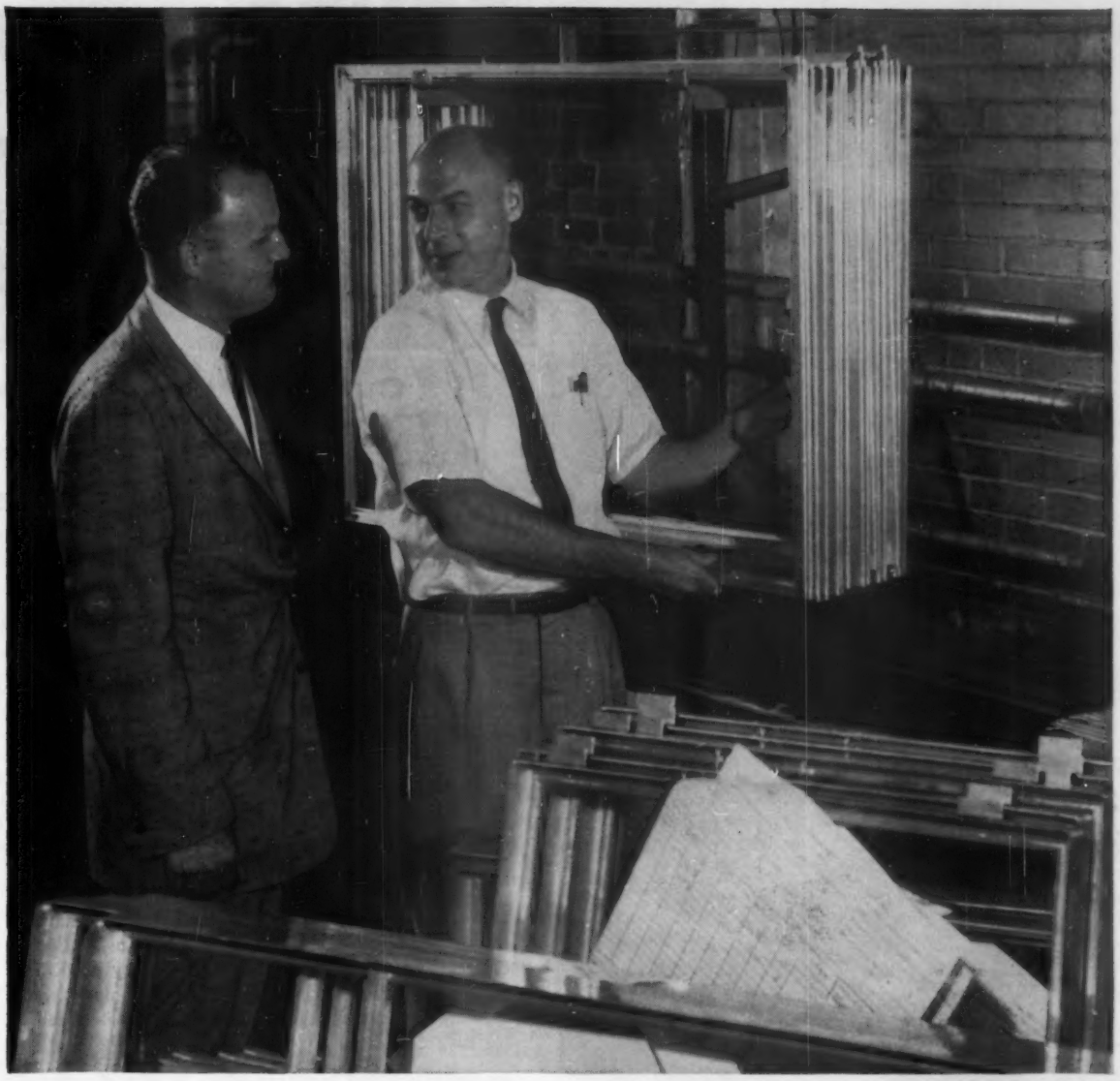
Every section of Kane's smartly designed, sturdy windows and doors has to be totally free of grease before painting or shipping.

Kane found that vapor degreasing is the only efficient way to economically clean intricate, precision engineered channels and grooves—necessary features for snug-fitting but smooth-moving window panels.

Kane Manufacturing Company of Kane, Pennsylvania, is a medium sized custom builder of a wide variety of metal screens, door frames, and window frames. Their output has to meet the demanding specifications of highly experienced purchasers, since they equip many institutional buildings—hospitals, schools, government agencies. Many of their orders call for painted parts, and before painting Kane has to be sure that the metal surface is perfectly clean and free of foreign matter. These products are exposed to all sorts of weather, too, and that makes a good—and lasting—paint job even more essential. And most of them have intricate grooves and channels—ideal starting places for rust and corrosion. Also, many of their products are made of aluminum, a material requiring a high-performance solvent.

To make certain they were using their vapor degreasing operation most efficiently, the production people at Kane called in their Columbia-Southern Technical Service Representative. The Technical Service man, working with the Columbia-Southern distributor, Western Pennsylvania Chemical Company, reviewed Kane's set-up and then made specific suggestions. After putting these into practice, Kane found that their operation was improved to the extent that they could handle the same volume of degreasing work using 30% less solvent. The quality of the degreasing was better than ever, and working conditions were considerably improved.

Workers in Kane's degreasing department like the thorough job Columbia-Southern Trichlor does in removing grease and other dirt. Once they have degreased a unit they can get on with the finishing operation in complete confidence. This enables them to set up smooth production cycles, without constant interruption for returning parts that are only partially degreased. And parts come out of the degreasing tank completely dry, so there's no need for a separate, time consuming drying operation. This thorough action means fewer man hours lost for cleaning out the degreasing tanks, too.



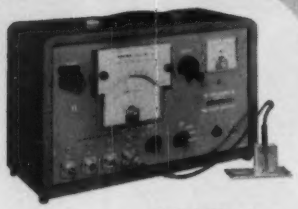
Lester Baum (right), Kane's Production Manager, discusses the improved degreasing operation with Ralph Reed, Sales Representative of Western Pennsylvania Chemical Company, who helped with the recommended changes.

Vapor degreasing at Kane is a smooth flowing operation, and it's finished as soon as parts are lifted out of the tank, because they're completely dry, and ready for the next step.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center, Pittsburgh 22, Pennsylvania

DISTRICT OFFICES: Cincinnati • Charlotte • Chicago • Cleveland • Boston • New York • St. Louis • Minneapolis • New Orleans • Dallas • Houston Pittsburgh • Philadelphia • San Francisco. IN CANADA: Standard Chemical Limited



DERMITRON NON-DESTRUCTIVE COATING THICKNESS TESTER

MEASURES METALLIC AND NON-METALLIC COATING THICKNESS

The DERMITRON **instantly and accurately** provides **direct readings** of metallic and non-metallic coatings and films. It is widely used and recommended for measurement of such coatings as: CADMIUM or ZINC on steel; SILVER on brass; ANODIZING, HARDCOAT, PAINT on aluminum, magnesium, etc.

Very simple to operate, the DERMITRON is compact, offering portability for both laboratory and production use. Four patented measuring probes are available for extra-wide thickness ranges from thick to thin deposits and enable measurements on small areas and previously inaccessible areas. You can rely on the DERMITRON NON-DESTRUCTIVE TESTER for any application where coating thickness must be controlled. **Write for current bulletins and price list.**

PERIODIC-REVERSE AND CURRENT-INTERRUPTION UNITS

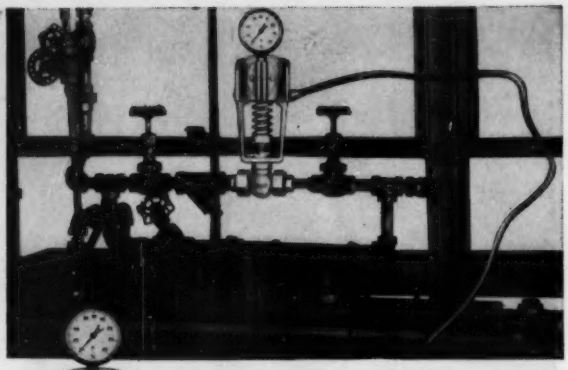
PERIODIC REVERSE UNITS are used with ALKALINE DERUSTING and DESCALING processes for more efficient and effective cleaning operations. **Write for Bulletin PR-AD-1.**

PERIODIC-REVERSE and CURRENT-INTERRUPTION UNITS—for PLATING of SILVER, COPPER, GOLD, BRASS, etc., this fine electronic equipment saves time, money and improves quality. It makes deposits smoother . . . faster . . . brighter . . . easier to polish . . . less porous . . . more uniform. And it's extremely simple to install and operate. **Write for current Bulletin PR-3 and prices.**

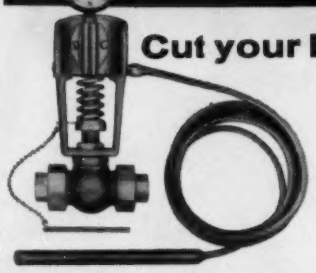
All requests for complete details are processed quickly.

UNIT PROCESS ASSEMBLIES, INC.
61 East Fourth Street • New York 3, N. Y.

UPA



Cut your Plating Costs



AMERICAN TEMPERATURE REGULATORS REACT TO DEVIATIONS AS SMALL AS 1/10° F.

. . . End Packing Gland Problems

Only the American Temperature Regulator has a friction-free bellows to seal off the valve stem. No sticking packing gland to retard valve action! You get a packless valve that *never* needs lubrication; *never* needs repacking. It enables the regulator to begin corrective action with less than 1/10°F. change in temperature at the bulb.

Low-cost American Temperature Regulators have standardized parts and unitized assembly. Installation costs less. No compressed air or electricity needed. Maintenance is practically nil. Dial thermometer accurately indicates the tank temperature; can be faced for easiest reading.

Reduce rejects and costly reworking. Stop overheating, boil off and breakdown of the solution. Get peak performance from high-production conveyorized equipment. Make certain of continuously uniform, high-quality plating and greater profit. Invest in American Temperature Regulators.

Sizes: ½" to 1½". *Temperature Range:* 130/220°F. standard. *Temperature System:* Bulb and line enveloped in plastic for longer service life. Bellows is Neoprene-protected against corrosion. *Valve:* Bronze body with stainless steel seat and disc. *Ask for Bulletin 115.*

Phone your industrial supply distributor for counsel, service, and prompt delivery from his local stocks.

AMERICAN TEMPERATURE REGULATORS
A product of
MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

The New STUTZ Plating Barrels

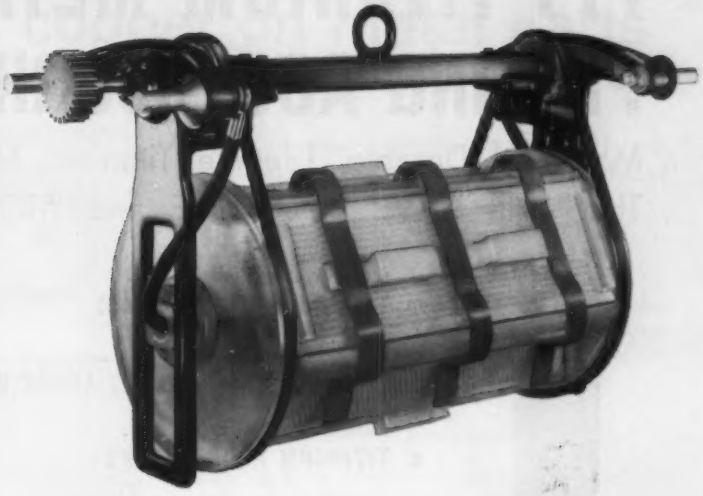
Low headroom design

New materials

Stutz complete cycle assembly for operation in tanks with driving mechanism located externally. Lifting and lowering of unit reduced to a minimum. Cylinder is totally submerged in operation. Belt drive is positive timing design and belts can be changed if necessary in seconds without tools. Saddle horns are located on 15" centers. Cathode contactors dangler type standard, other types available. Cylinder hangers are cast steel protected with special hard rubber or fused vinyl chloride.

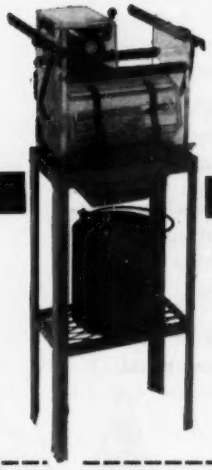
Cylinders can be supplied in special sizes, partitions if necessary and special cathode contactors as required.

Barrel assembly units are made to fit all makes of tanks.



. . PLEXIGLAS • POLYPROPYLENE • TEMPRON • MELAMINE . . .

Cylinder rotation in this design is provided by motor drive mounted directly in super structure bridge member. Total weight and overall height has been greatly reduced. Handling therefor is fast and smooth. Cylinder transported from one operation to the next under continuous rotation. In this manner solution dragout is reduced to a minimum. Rinsing time following alkali cleaning, acid pickling, etc., is greatly reduced. Overall dimensions of tanks is lessened by the elimination of motor drive platform. Electric service 440, 220, or 115 volt with grounded cable and Hubble-lock heavy duty safety connector.



Sizes 12" to 18" inside diameter—24" to 42" long — perforations 3/32" standard. All other sizes available.

Tanks in single and multiple — Power equipment — dryers — filters — heat exchangers — chemicals — anodes — ventilation, etc.

Also Adaptable for Tanks Other Than Ours.

STUTZ *Portable Plating Barrels*

The Stutz Portable Barrel is made in 3 standard sizes with cylinders having inside dimensions of 6"x12", 8"x18" and 10"x20" I.D. Smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

- **Baskets in perforated metals or wire mesh.**
- **Load/Unload Stand for convenient and fast handling of work load.**

Write for Catalog and Prices

The STUTZ Company

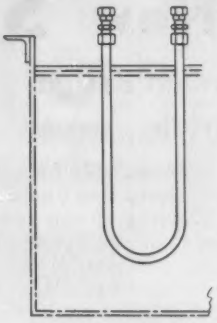
We Invite your Inquiries

4430 West Carroll Ave. Chicago 24, Ill.

COMPLETE METAL FINISHING EQUIPMENT AND SUPPLIES

PPI TITANIUM METAL PLATING ACCESSORIES

Made Of Durable, Lifetime Titanium Metal
That Will SAVE YOU TIME and MONEY



HEATING COILS

PATENT PENDING
"Scrap Saver"
ANODE BASKETS

Maintenance Free . . . . .
- **TITANIUM HEATING COILS**

Sturdy - Longlasting . . . . .
- **TITANIUM "Scrap Saver" ANODE BASKETS**

Durable - Lifetime . . . . .
- **TITANIUM ANODE HOOKS**

WRITE TODAY FOR NEW FREE LITERATURE...Titled, Titanium Metal Plating Accessories

PATENT PENDING

ANODE HOOKS

PLATING PRODUCTS, Inc. 1509 N. Washington St., Kokomo, Indiana

---

Rhodium

ELECTROPLATING SOLUTIONS

Backed by 58 Years of Specialization

Technological knowledge acquired through many years of experience, plus special processes and equipment, assure the high quality of our Rhodium Plating Solutions.

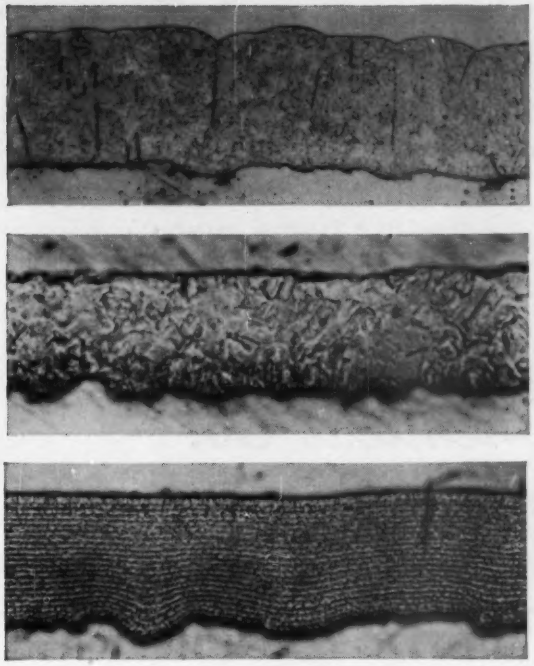
Recommended for contact surfaces of switches, waveguide parts and other electrical applications, such as printed circuits...Can be applied in extremely heavy deposits, up to 100 milligrams per square inch.

Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

Consult our staff about plating problems.

SIGMUND COHN MFG. CO., INC.
121 SOUTH COLUMBUS AVENUE · MOUNT VERNON, NEW YORK

New Du Pont process deposits level coat of protective copper on metal parts



Three photomicrographs show a 0.001-inch thickness of copper plated on polished steel of 24 RMS (750 magnification)

1. Conventional copper plating

Note the columnar structure and the uneven copper surface you get with conventional copper plating using direct current.

2. Du Pont process—interrupted current

Note the amorphous structure and the relatively level copper surface you get with Du Pont's process. Interrupted current is used where maximum leveling is not required.

3. Du Pont process—current reversal

Note the laminar structure and the extremely level copper surface obtained with Du Pont's process. Current reversal is used where maximum leveling is required.

Du Pont's Leveled Copper Process gives you lower finishing costs... improved appearance of plated parts . . . better corrosion resistance

Du Pont research has found a way to cover the "peaks and valleys" of metal surfaces with a uniform coat of protective copper—during the plating process. Here are the advantages:

For plating on zinc die castings:

1. Covers minor imperfections
2. High reflectivity
3. Excellent hiding power
4. Good corrosion resistance
5. More uniform plate distribution because of high throwing power

For plating on polished steel:

1. Levels peaks and valleys of polish marks
2. Superior corrosion resistance
3. More uniform plate distribution because of high throwing power
4. Less buffing required
5. Lower over-all finishing costs

A combination of unique chemical additives and current variations is the basis of Du Pont's leveled copper-plating process:

1. A high efficiency cyanide copper bath
2. Special Du Pont addition agents, Elchem 1396 and Elchem 1442M
3. a. Interrupted or direct current where maximum leveling is not required or . . . b. Current reversal (for maximum leveling), 60-second plating, 20-second deplating
4. Agitated electrolyte

Du Pont's leveled copper plating can be adapted to most plating operations easily, quickly and inexpensively. Contact your nearest Du Pont District Office for information on how you can save money and time—improve your finished product.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

ELECTROCHEMICALS DEPARTMENT
Sodium Products Division

E. I. DU PONT DE NEMOURS & CO. (INC.)
Wilmington 98, Delaware

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STRIPEX #153

THE NEW MIRACLE

PAINT STRIPPER

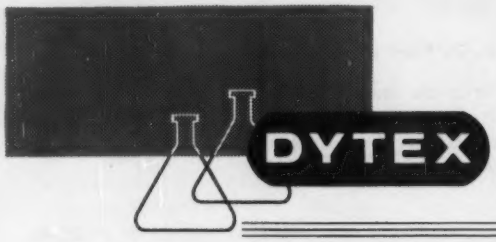
NO HEAT NECESSARY!

A mild steel tank is all that is required. Strips all types of baked enamels.

Some baked coatings are stripped clean in a matter of seconds.

Excellent for stripping.

Enamels and Lacquers • Melamines • Zinc Chromate Finishes • Plastisols • Vacuum Plated Finishes • Plating Racks • Insulating Varnishes • Epoxy Finishes • Rubber Coatings • Vinyl Coatings



DYTEX Chemical Co.

140 INDIA STREET • PROVIDENCE 3, RHODE ISLAND

TELEPHONE JACKSON 1-6570

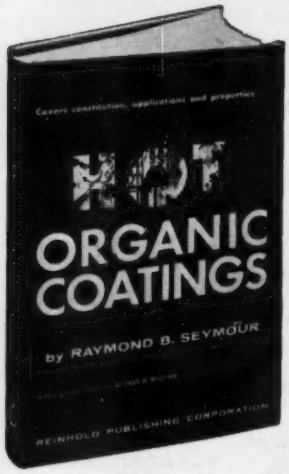
Covers constitution, applications and properties.

HOT ORGANIC COATINGS

by RAYMOND B. SEYMOUR
President, Alcylite Plastic and Chemical Corporation
With a special chapter by GEORGE B. McCOMB
Consultant to Suppliers of Pipe Line Coatings

1959, 244 pages, $7.50

The constitution, applications and properties of hot organic protective coatings are concisely presented here. The book contains chapters on widely used hot organic materials such as asphalt, coal-tar pitch, petroleum waxes and cellulose derivatives. Specific information on formulations of proprietary products is included. Additional chapters deal with hot melt applications without solvent such as peel coatings, protective linings, flame spraying and the fluidized bed process. One chapter on hot applied coal tar pitch base coatings is supplied by George B. McComb, consultant to the leading suppliers of pipe line coatings. Hot spray techniques and the many advantages of this application are also covered. This book will be helpful to everyone using these coatings in any form.



CONTENTS:

Coating Fundamentals
General Discussion of Hot Coatings
Asphalt and Related Products
Coal Tar Pitch
Petroleum Waxes
Synthetic Hydrocarbon Resins
Cellulose Derivatives
Animal, Vegetable & Insect Waxes
Miscellaneous Products
Applications in the Absence of Solvent
Hot Applied Coal-Tar Pitch Base Coatings
Hot Solution Applications
Tests
Trends and Potentials of Hot Coatings
Index

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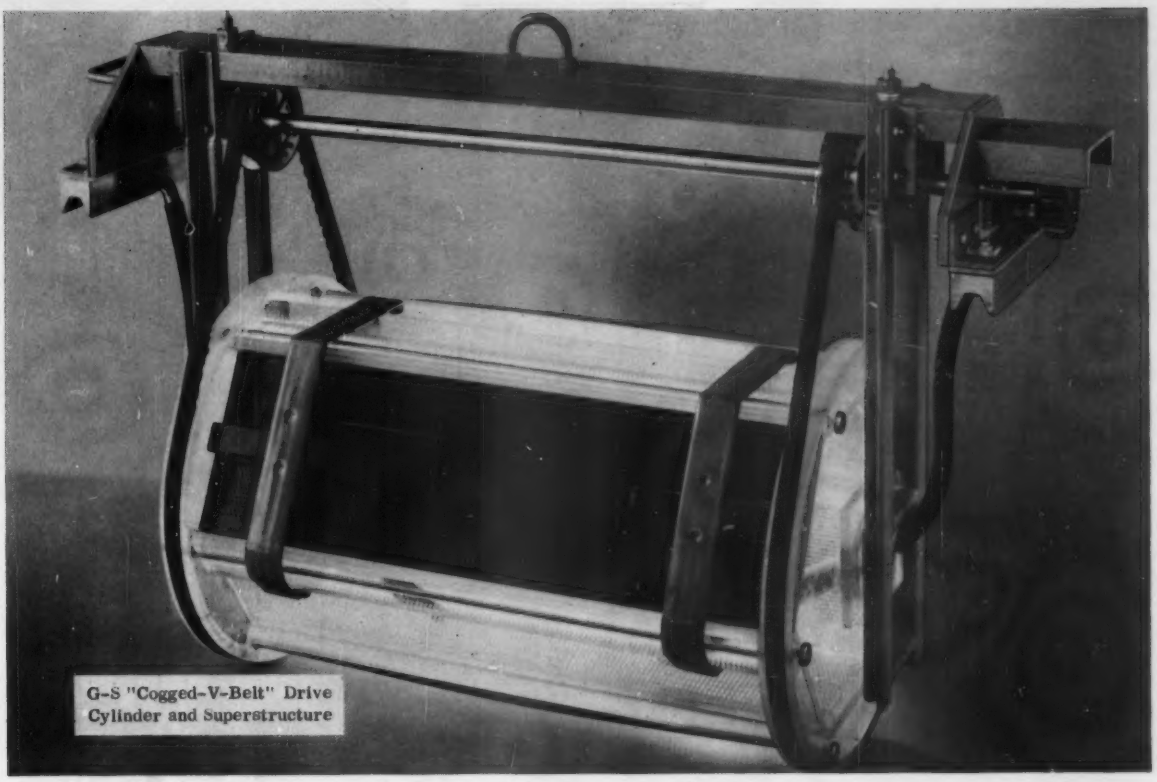


G-S "Cogged-V-Belt" Drive Cylinder and Superstructure

"$2 Bonus with Every $5 Profit": *Yours from G-S!*

G-S equipped platers report even bigger profits. The reasons: Better, Faster Plating at Lower Operating and Maintenance Costs.

G-S alone gives you these features!

★ **G-S "Cogged-V-Belt" Drive and Cogged Drive Pulleys** (U. S. Pats. 2,562,084 and 2,886,505). "The Belt-Drive with the Gear-Grip" eliminates cylinder-end drive gear, idler gear, pinion gear, 3 bearings. No gears or bearings in solution. No gear maintenance. Outlasts, outperforms all others.

★ **Longer Inverted V-Contacts**—48" contact area. 30% greater current flow. Also horn types for all makes of tanks.

★ **Floating End Plates** for constant contact using Inverted V-Contacts or Horn Type. Can't rock.

★ **Adjustable Bearings** support drive shaft. Maintain constant-mesh with drive gears.

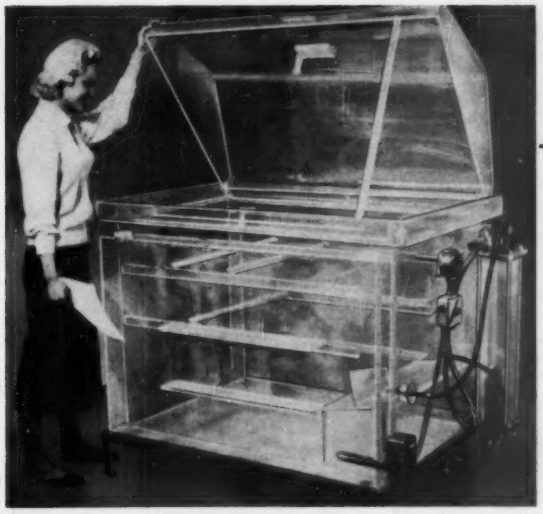
★ **Floating Hubs with Locking U** for directing danglers downward. Easier, faster disassembly, dangler cleaning, etc.

★ **Heavier Dangler Cables** for higher current capacity, longer life, better operating.

★ **Rugged G-S Bolted or Welded Cylinders** of "H-T Plexiglas", "Tempron", or Poly — any combination of components. Heavy ribbed construction. Loads to 275 lbs. Temperatures to 220°F.

★ **More G-S Barrel Features** — Automatic Positioning of superstructures, Total Cylinder immersion, Single-Screw Adjustable Motor Mount on tank. Three-Speed Drive-Pulleys, and many others.

Get the facts! Investigate the new, low-cost G-S Conversion Plan for **your** plant. Pays for itself in maintenance savings alone. Inquire now.



Complete Equipment for Your Still Plating and Barrel Plating. G-S Replacement Cylinders to fit all makes, types, sizes, ages of superstructures. **G-S "Cogged-V-Belt" Drive Conversions** (cylinder-superstructure comb.) to fit all tanks. **G-S "Cogged-V-Belt" Drive Barrels** complete with tanks. Plating's top performers! **G-S Tanks, Liners, Hoods, Motor Drives, Dryers, Chute Loaders, etc.**

Test 'em yourself . . . Cut Time, Costs!

G-S CORROSION TEST CABINETS

• Salt Fog • Acetic Acid • Humidity • Corrodkote • Cass Tests

Your automotive and appliance customers want tests on a piece-per-hour basis. Answer: **In-plant tests with low-cost G-S Cabinet.** No outside delays, red-tape, high costs. Prompt deliveries mean satisfied customers, quicker returns. G-S Cabinets offer highest uniform accuracy. Meet A.S.T.M. and Gov't Specifications. All-welded "H-T Plexiglas", also lined steel or lined Stainless — sizes, types to suit. Send for details, prices.

The G-S Equipment Co.

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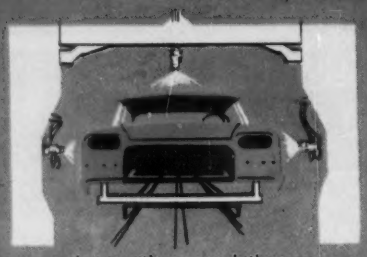
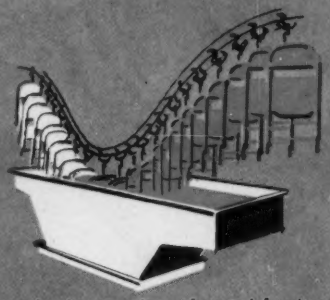
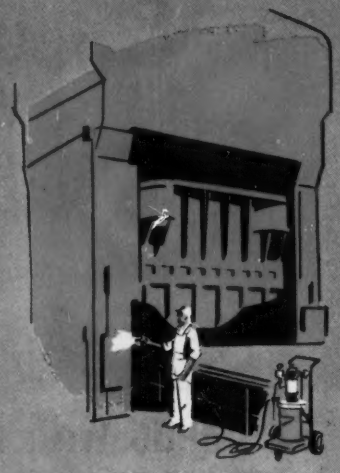


Automatic car painting

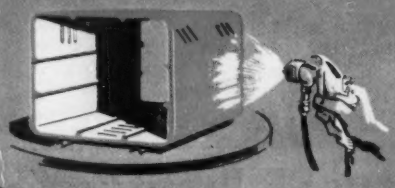
Fiberglass boat fabrication



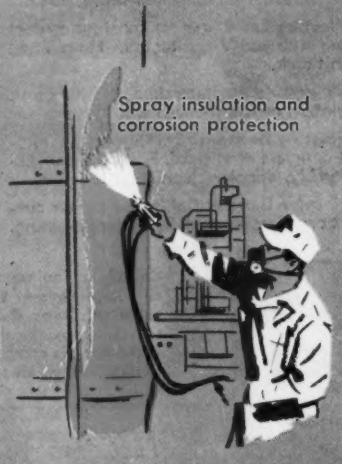
High production coating of metal furniture



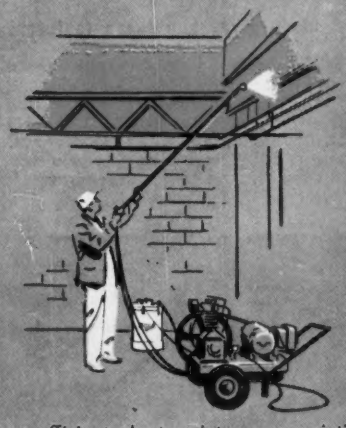
In-plant painting of bulky machinery



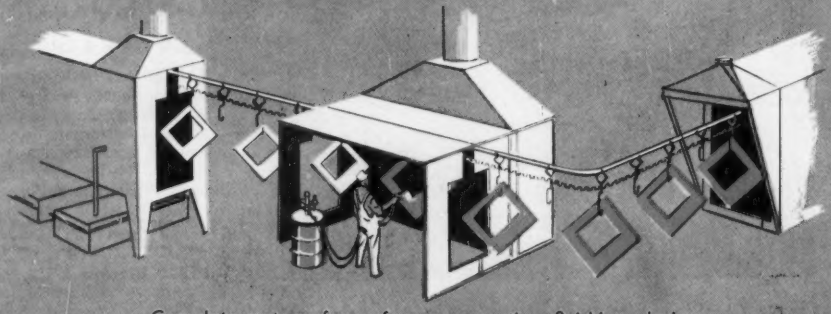
Quality finishing with built-in sales appeal



Spray insulation and corrosion protection



Fast, efficient plant maintenance painting



Complete systems for surface preparation, finishing, drying

FOR BETTER SERVICE, BUY

DEVILBISS

THE DEVILBISS COMPANY

TOLEDO 1, OHIO

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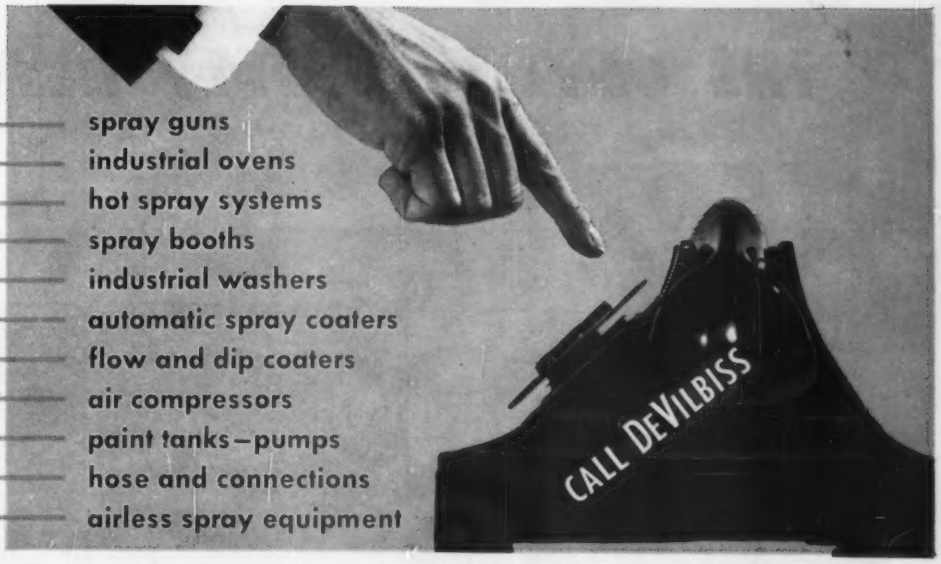
São Paulo, Brazil

Branch Offices in Principal Cities

MANAGEMENT OBJECTIVE:

Determine best method and equipment for surface preparation and coating

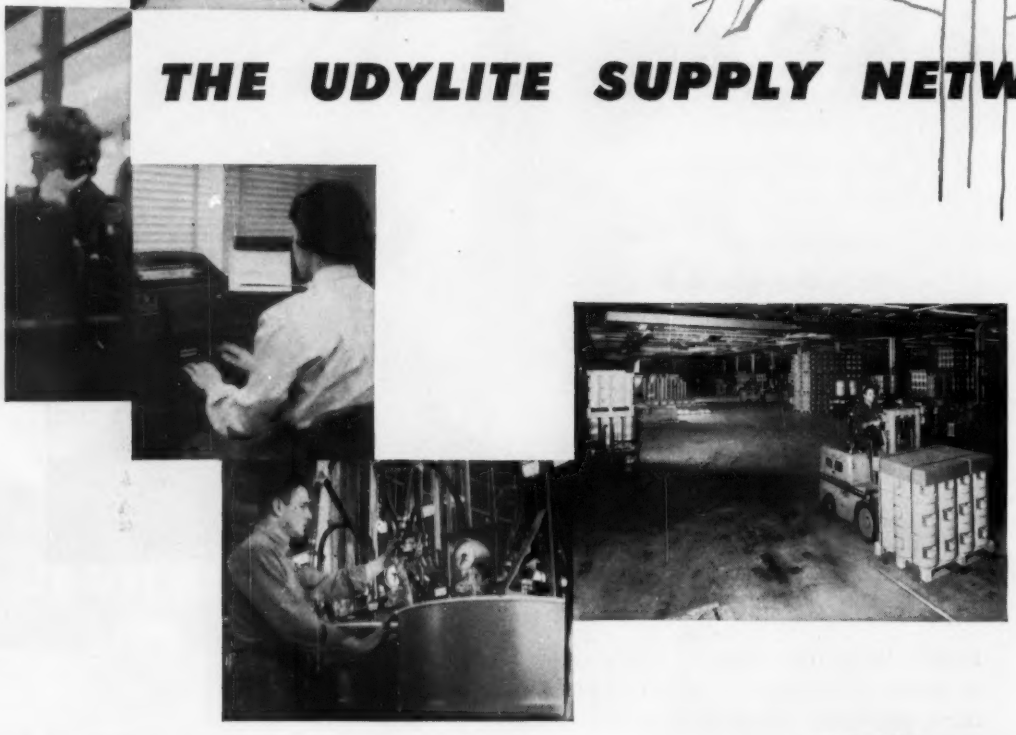
ACTION: Contact DeVilbiss



HERE'S WHY: With the industry's most complete line of surface-preparation and coating and finishing equipment to draw on, DeVilbiss can supply you with matched components that complement one another to form a smooth-functioning system tailored to your requirements. DeVilbiss is the one "single source" fully qualified to analyze your needs, then let you select the best, most economical product combination to fit your job. Engineering and service facilities are available coast to coast. Just contact our nearest branch office, or write us direct.

plating progress ✻

THE UDYLITE SUPPLY NETWORK

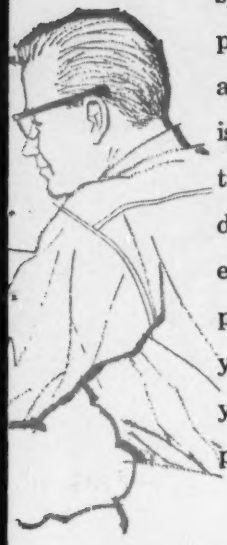


world's largest plating supplier

the **udylite**

corporation

detroit 11, michigan



Telephone, teletype and cable, a globe-circling network of depots, the speed of jet-age transportation are all at your command when you order plating supplies from Udylite. The supplies service team comprising a large and intricate complex of communications, warehousing, and personnel is set in motion with the receipt of your order. What you *get* is the finest quality, the newest exclusive processes, in the most advanced packaging available, delivered with exactness, and speed. Within twenty-four hours—even less if necessary—your order can be on its way to you from the nearest point of availability. In time to keep your production line moving you receive your Udylite supplies, of quality, weight and price you know you can depend upon. This is indeed "worry-free" buying provided for you by Udylite.

MEANS WORRY-FREE BUYING FOR YOU

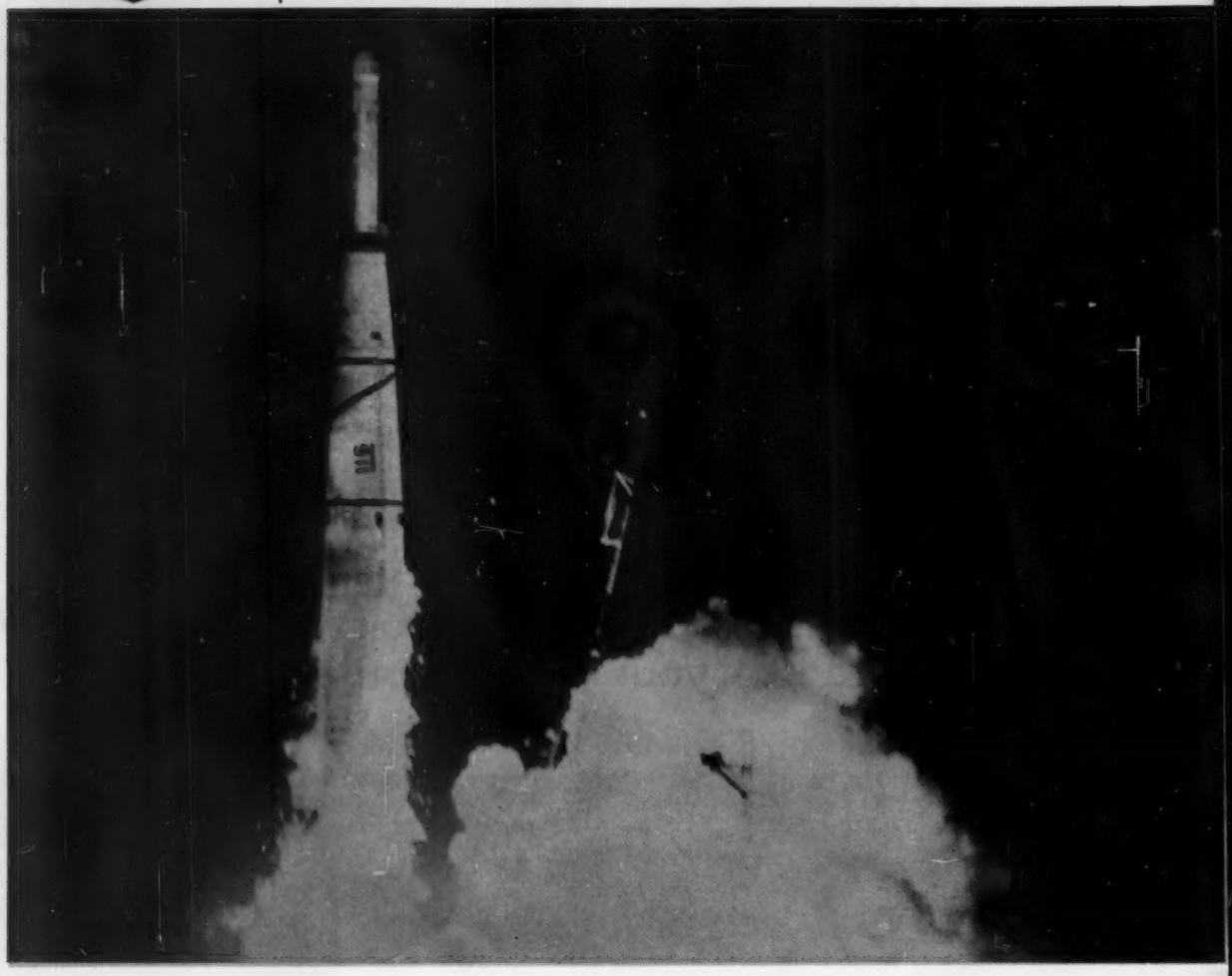
...helps guarantee your production quotas

* Not customary but entirely "in order" is this shipment, rushed by Udylite messenger directly to planeside in Detroit for emergency delivery to a customer in Johannesburg, South Africa. The delivery was made in just 39 hours at a distance of 9036 miles in time to avert a production halt and provide the customer with typical Udylite supply service satisfaction. Udylite special delivery joins with the world's speediest common carriers to deliver your order tomorrow, if that's how fast you need it.

DOW

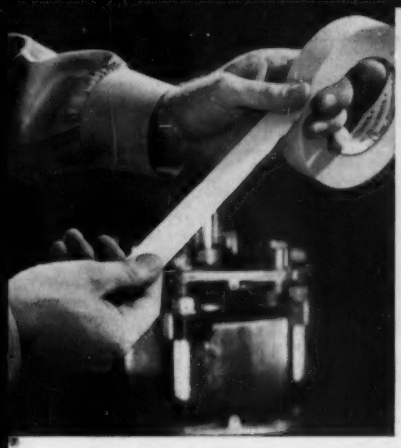
metal cleaning report no. 4

case histories from your distributor of Dow solvents



MISSILE COMPONENTS . . . no place for "almost clean"

An aircraft parts manufacturer, under sub-contract to deliver missile components, had a serious production problem. His regular vapor-degreasing solvent gave results which, at best, were not quite good enough for certain critical missile parts. As a result of a consultation with his distributor of Dow solvents, this manufacturer put NEU-TRI® to work . . . now his missile components *and* his standard line of aircraft parts come off the line thoroughly cleaned. He also gained a cost advantage: a long-lived neutral stabilizing system built into NEU-TRI prevents early solvent breakdown. Consequently he now can clean more parts with a gallon of solvent than ever before!

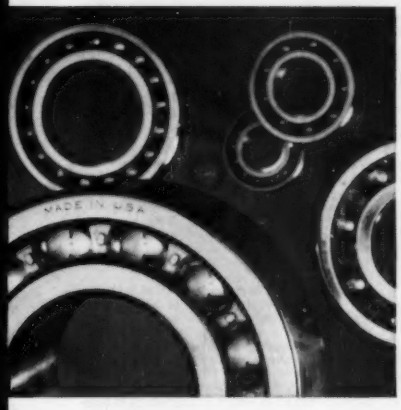


ELECTRICAL PARTS

The bottleneck was tape. This company makes electrical parts. During one stage of assembly, masking tape must be applied to certain critical parts. And the time and careful handling required to remove the tape at final assembly provided a real production bottleneck! They found the answer with Chlorothene® (Dow 1, 1, 1-trichloroethane, inhibited). Because of its high solvent power, Chlorothene takes tape off *fast.*

ELECTRONIC COMPONENTS

Choice of spray or wipe—This manufacturer of electronic parts states: "Chlorothene is the finest all-around solvent we've ever used." Chlorothene is widely used throughout the plant for both spray and wipe cleaning of the electronic parts, *and* for cleaning of production equipment! There's no fire or flash point by standard testing methods, and toxicity is very low, which keeps this safety-conscious management happy.



BALL BEARINGS

Teamwork for protection—This bearing manufacturer found nonflammable Dow perchloroethylene an ideal solvent for use in a combination cleaning-and-oil-bath formulation. Completed *ball-and-race* assemblies, dipped in the solution, came out completely free of all dirt and contaminants deposited during manufacture and assembly . . . while retaining a thin film of oil for protection during packaging and storage.

GAS EQUIPMENT

Solvent *cleans-and-goes in a hurry*—Cleaning of compressed gas tubes and lines can be a problem, but this company does the job the easy way. On the recommendation of their distributor of Dow solvents, they tried Dow methylene chloride. Its high solvency quickly, thoroughly removes grease, oil and other processing residue . . . and any solvent remaining after treatment evaporates in a hurry!

There's no doubt about efficiency in metal cleaning operations when one or more of the Dow metal cleaning solvents is on the job. Dow offers industry the widest line of chlorinated solvents, each one designed for specific applications and purposes. There's a Dow solvent to meet every solvent-cleaning need . . . one which will do the job efficiently, in short order!

Your distributor of Dow solvents is fully qualified to assist and advise you when problems of metal cleaning arise. Why not take advantage of the wide experience and knowledge which he and his staff have to offer? A call to him may be a shortcut to more efficient, economical metal cleaning in *your* plant.

FREE . . .
TECHNICAL SERVICE
on 24-hour notice

Your distributor of Dow solvents will gladly help you with any problems you're experiencing with metal cleaning solvents. He'll have a trained solvents specialist en route to your plant within 24 hours after your call is received.

Ask your distributor of Dow solvents for details.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

CHLOROTHENE®
TRICHLOROETHYLENE
PERCHLOROETHYLENE
METHYLENE CHLORIDE

See Your Distributor of Dow Solvents First!

FOR HELPFUL METAL CLEANING INFORMATION

get in touch with your Dow Solvents Distributor

DOW

LETTER KEYS: (C)—Chlorothene®; (M)—Methylene Chloride; (P)—Perchloroethylene (Industrial); (T)—Trichloroethylene

ALABAMA
BIRMINGHAM—Wittichen Chemical Company (C M P)
BIRMINGHAM—F. H. Ross and Company (C M P T)
MOBILE—Barada and Page, Inc. (C M)
MOBILE—McKesson & Robbins, Inc. (C M P T)
MOBILE—F. H. Ross and Company (C M P)
MONTGOMERY—Wittichen Chemical Company (C M P)

ARIZONA
PHOENIX—Braun Chemical Company (C M P T)
PHOENIX—Western Chemical Company (C M P)
TUCSON—Western Chemical Company (C M P)

CALIFORNIA
LOS ANGELES—Braun Chemical Company (C M P T)
LOS ANGELES—McKesson, Mefford Chemical Division (P)
LOS ANGELES—Pemaco, Inc. (P T)
OAKLAND—B. N. Meacham Company (C)
SAN DIEGO—Braun Chemical Company (C M P T)
SAN DIEGO—Buel Town Company (T)
SAN FRANCISCO—Braun-Knecht-Heimann Co. (C M P T)
SAN FRANCISCO—G. N. Meacham Company (C)
SOUTH GATE—American Mineral Spirits (P)

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DENVER—Chemical Sales Company (C M P T)
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DENVER—Mine and Smelter Supply Company (C M P T)
GRAND JUNCTION—C. D. Smith Co., Chemical Div. (C P T)

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SOUTH NORWALK—Guard-All Chemical Company (P T)

FLORIDA
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MIAMI—Amica Burnett Chemical Company (C M P T)
MIAMI—Biscayne Chemical Laboratories (C M P T)
ORLANDO—Atlantic Chemicals, Inc. (C M P T)
TAMPA—Atlantic Chemicals, Inc. (C M P T)
TAMPA—McKesson and Robbins, Inc. (C M P T)

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ATLANTA—McKesson and Robbins, Inc. (C M P T)
ATLANTA—F. H. Ross and Company (C M P T)
ATLANTA—Southern States Chemical Company (C M P T)
BIRMINGHAM—Chapman Chemical Company (T)
COLUMBUS—F. H. Ross and Company (C M T)
DUBLIN—Textile Aniline Chemical Company (T)

IDAHO
BOISE—Van Waters and Rogers, Inc. (C M P)

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CHICAGO—Central Solvents and Chemicals (C M P)
CHICAGO—C. P. Hall Company (C M P T)
CHICAGO—Keystone Aniline and Chemical Co. (C P)
CHICAGO—McKesson & Robbins, Inc. (C M P T)
CHICAGO—Joseph Turner and Company (C M P T)
DECATUR—McKesson & Robbins, Inc. (C M P T)
EFFINGHAM—Wabash Independent Oil Company (C P T)
MELROSE PARK—London Chemical Company (P T)
PEORIA—McKesson & Robbins, Inc. (C M P T)
ROCKFORD—Industrial Oil and Chemical Company (C)
ROCKFORD—Viking Chemical Company (C M P T)

INDIANA
EVANSVILLE—Barning Industrial Chemicals (C M P T)
EVANSVILLE—Charles Leich and Company (P)
FT. WAYNE—Hoosier Solvents and Chemicals (C M P)
FT. WAYNE—Inland Chemical Corporation (C M P)
HAMMOND—Inland Chemical Corporation (C M P T)
INDIANAPOLIS—Hoosier Solvents and Chemicals (C M P)
INDIANAPOLIS—Wm. Lynn Chemical Company (C M P)
INDIANAPOLIS—Ulrich Chemical Company, Inc. (C T)
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DES MOINES—Barton Naphtha Company (C M P T)
SUMNER—Overton Chemical Sales (C)

KANSAS
WICHITA—Barada and Page, Inc. (C M)
WICHITA—Reid Supply Company (C P T)

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NOVEMBER, 1959 Volume 57 No. 11

FEATURES

Editorial — Keeping Pace with Progress 59

Treatment of Combined Finishing Wastes 60
By Dr. Alvin G. Winger

Conversion Coatings — Phosphate Films 64
By Lester F. Spencer

Immersion Plating on Zircaloy-2 68
By Leonard R. Kohan

The Electrochemical Society 74

Science for the Coatings Technologist — Part XIV 76
By E. S. Beck

Science for Electroplaters — Part LII 80
By L. Serota

DEPARTMENTS

Shop Problems 84
Patents 86
Abstracts 90
Recent Developments 92
Business Items 101
New Books 112
News from California 113
Associations and Societies 115
Manufacturers' Literature 122

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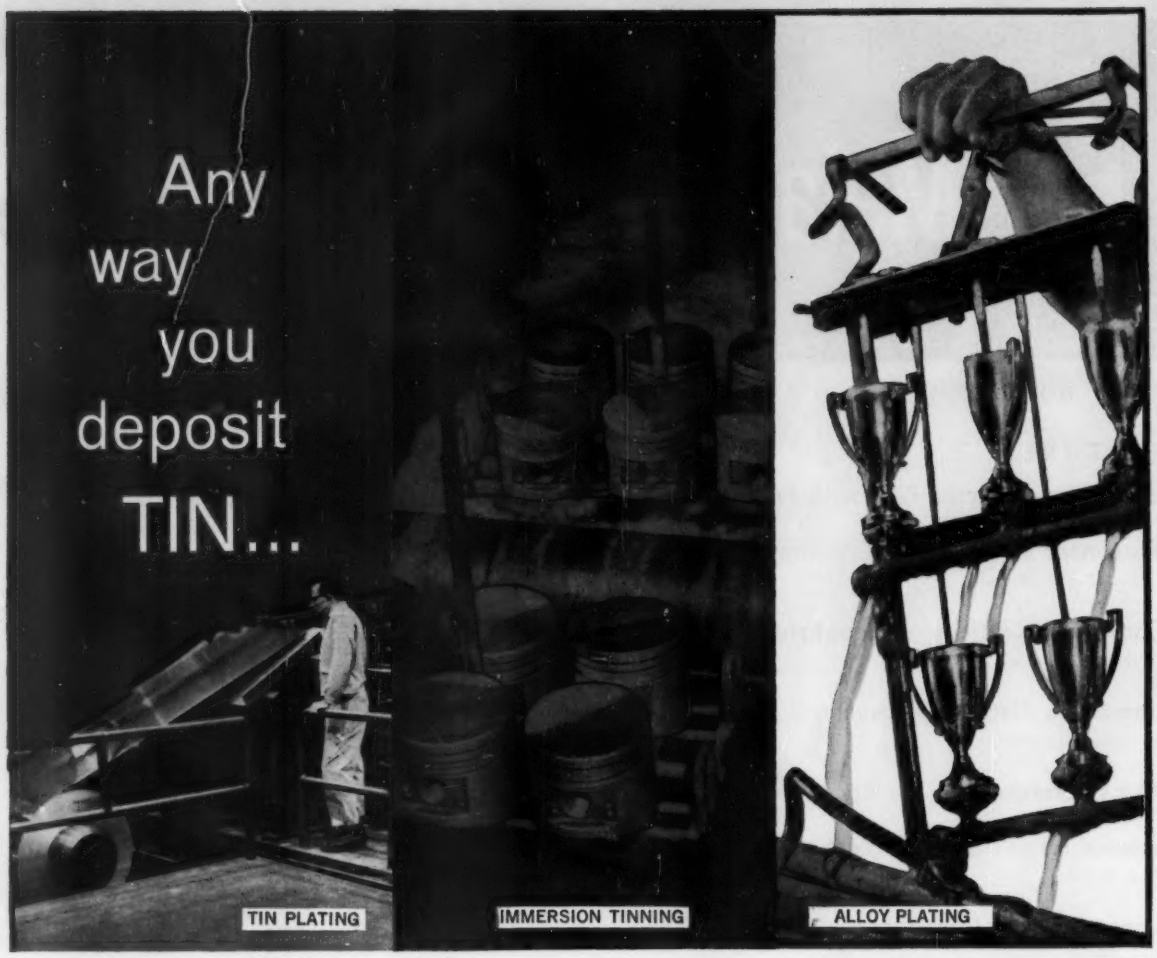

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KEEPING PACE WITH PROGRESS

It took a simple request by a subscriber, for clarification of the term "wash primer," to bring home to us how rapid can be the march of progress in the field of finishing. Since an editorial on the subject appeared on this page last year, the most effective course, naturally, was to forward a copy. However, upon glancing over the editorial, it immediately was obvious that, in the course of only one year, the information had become completely outdated and would no longer serve as a suitable reply to the inquiry.

Yesterday, it was sufficient to differentiate between "single-pack" and "two-pack" primers, and to but mention that modifications were on the way; today, the modifications have arrived! For the clarification to be comprehensive now, it must include additions to the finishing nomenclature — "reactive" wash primers, "non-reactive," and "reacted" types, for example.

Essentially, all wash primers consist of prosphoric acid, a polyvinyl acetal resin, and chromate pigment, combining in the resultant film the properties of a chemical conversion treatment and a paint primer. The old two-pack reactive material is still the one most commonly used, due to its superior adhesion and effectiveness in retarding corrosion, despite the necessity for application to a surface within 24 hours after mixing the two components. The non-reactive and the reacted primers are both single-pack systems and are stable for months, as against hours, the former being produced by adding phosphoric acid to a dispersion of metal chromates in butyral resin, and the latter by reacting the resin with chromic and phosphoric acids at elevated temperature to produce a clear, green lacquer.

The progressive metal finisher must familiarize himself with new modifications as they are developed and marketed, because they may offer some present or future advantages for his particular applications. Wash primers can now be formulated that are suitable for other metals beside iron and steel, including aluminum, zinc, copper, and a wide variety of alloys. He will have to select the most suitable primer on the basis of the metal to be finished, the degree of protection and adhesion required, whether or not high temperature baking of the top coat is specified, how much it is necessary to upgrade the performance of the final finish, and the temperature and humidity conditions he must contend with in his plant.

As someone aptly put it, things are moving so fast, one has to keep running to stand still these days!

Nathaniel Hall

Treatment of Combined Finishing Wastes

By Dr. Alvin G. Winger, *Ion Exchange Dept., Rohm & Haas Co., Philadelphia, Pa.*

ION exchange provides the key to the problem of handling toxic wastes in the rinse water from nearly 20 different plating, anodizing, and metal finishing baths (Fig. 1) at the Bristol, Tenn. plant of Raytheon, Co.'s Missile Systems Division, where components for the Navy's Sparrow III are produced. Now in its fifth year of operation, this waste treatment system is believed to be the first which approached the problem of handling all types of plating rinse wastes on a combined basis.

The rinse waters contain copper, chromium, heavy metals, cyanides, and a variety of other salts in plating copper and steel alloys, and in anodizing aluminum. A more complete listing of these contaminants is given in Table I. In addition to solving the toxic waste problem, the system produces a useful by-product — high-quality deionized water which is reused as plating rinse water and make-up water for the plating baths.. About 70,000 gallons of deionized water are recovered per day.

The combined rinse wastes, after preliminary filtering, are passed through cation and anion columns, operated in hydrogen and hydroxyl forms respectively. All ionized materials are removed from solution and the resulting effluent from the anion columns is deionized water of triple-distilled quality. The ions absorbed by the ion exchange reins are later removed when the columns are regenerated. The acidic and alkaline solutions from the regeneration process are treated separately to eliminate the cyanides and convert the chromates to a removable form. The acid and alkaline wastes are then blended, the chromates and heavy metals are precipitated, and the neutralized effluent is diluted and discharged.

Fig. 1. Overall view of plating shop in Bristol, Tenn. plant of Raytheon's Missile Systems Division.

The system is designed to handle solutions having a maximum dissolved solids content of 200 ppm. as $CaCO_3$. The maximum flow rate is 300 gpm. with both pair of ion exchange columns in operation. The usual service flow rate is 100 gpm.

Extraction of Contaminants

A schematic flow diagram of the waste treatment system is shown in Fig. 2. The rinse water from the various plating and finishing baths is collected in a common sump in the plating room, whence it is pumped to a 10,000-gal. capacity contaminated water storage tank. An automatic level control adds additional water, as required, to the storage tank to assure a rate of production of demineralized water sufficient for all rinse water requirements irrespective of the amount of contaminated water being reclaimed. From the storage tank the contaminated water (with additions) is pumped through 150-mesh metallic filters to remove suspended solids, and through activated carbon filters (Fig. 3) to remove wetting agents and other dissolved organic materials.

Heavy metals, chromates and all other cations are removed from the contaminated water and exchanged for hydrogen ions upon passing through the two cation exchange units. Each unit contains 130 cu. ft. of a nuclear sulfonic-acid type ion exchange resin. The effluent from the cation exchangers passes through the anion exchange units, each containing 125 cu. ft. of a strongly basic anion exchange resin, which extracts the anionic material. Here the hydroxyl ions released by anion exchange resin combine with the free hydro-

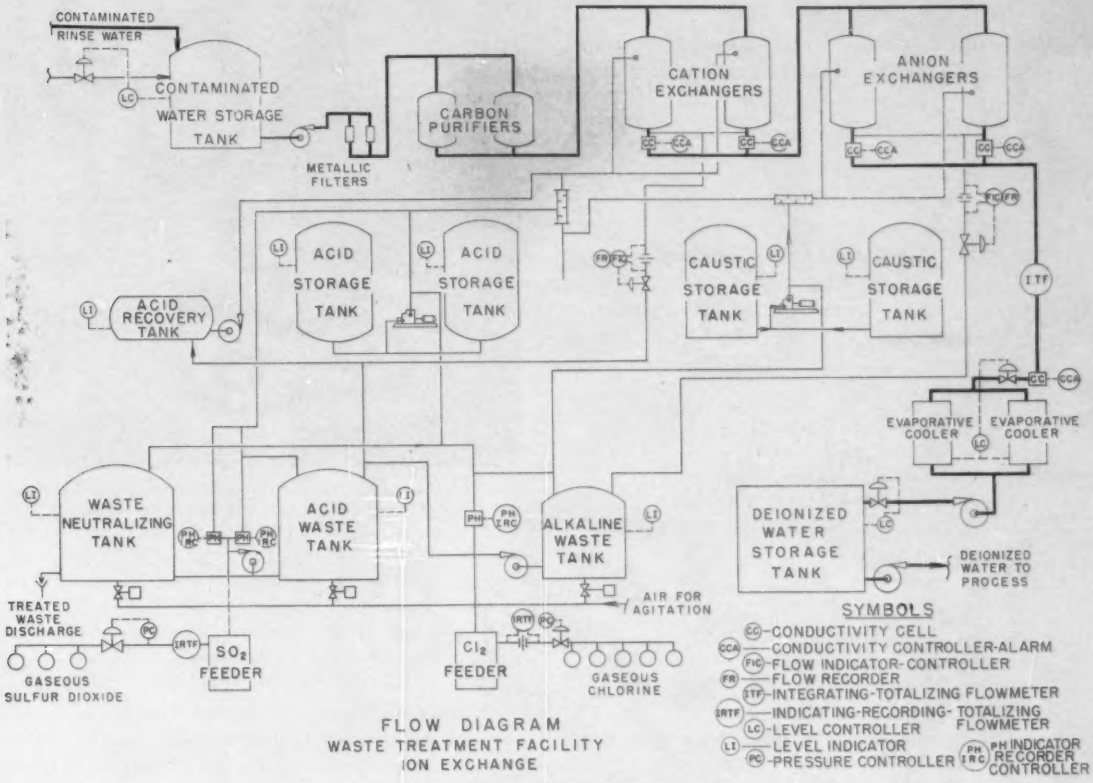

Fig. 2. Schematic flow diagram of treatment system.

gen ions from the cation exchange resin to produce ion-free water of high purity. This deionized water is stored in a 23,000-gal. tank, from which it is drawn as needed to make up new plating solutions and to be used as rinse water.

A conductivity cell at the outlet of each ion exchange unit monitors effluent quality and actuates an alarm when the concentrations of ionized material exceeds a certain level, indicating approaching exhaustion of the ion exchange resin. For the cation resin, the end point is 50 micromhos; for the anion resin, 8 micromhos. For approximately 80% of the operating cycle, the quality of the deionized water delivered from the anion exchange units is between 3 and 4 micromhos — equivalent to triple-distilled water.

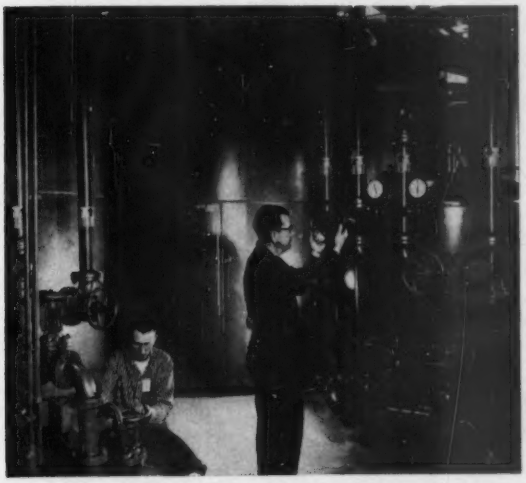

Fig. 3. Dual unit activated carbon filters to remove wetting agents and surface active components from waste solutions prior to treatment by ion exchange process. The alkaline waste tank, acid waste tank, and neutralizing tank are shown in the background.

TABLE 1

Partial list of plating and metal finishing solutions used at Raytheon. Rinse water from these operations are combined and treated through the ion exchange system.

Cadmium, cyanide
Hard chromium
Copper, cyanide
Nickel, chloride
Nickel, sulfamate
Silver, cyanide
Gold, cyanide
Rhodium, sulfate
Tin, Lead, fluoborate
H_2SO_4 Anodize
CrO_3 Anodize
Dips, including HCl, H_2SO_4, HNO_3, HF, zincate, NaOH
Proprietary stripping solutions, cleaners, conversion coating baths

TABLE 2

Regeneration conditions for ion exchange units

Regeneration Cycle

Cation Units

1. Backwash
   - Rate ..... 140 gpm.
   - Duration ..... 10 minutes
2. Introduce Regenerant
   - Rate ..... 2.66 gpm. of 66° Bé H_4SO_2, 95 gpm. of dilution water
   - Concentration ..... 5% H_2SO_4 by wt.
   - Amount ..... 1200# of 66° Bé H_2SO_4
3. Rinse
   - Rate ..... 120-150 gpm.
   - Duration ..... 30 minutes
   - Volume ..... 3,000-4,000 gal.

Anion Units

1. Backwash
   - Rate ..... 100 gpm.
   - Duration ..... 10 minutes
2. Introduce Regenerant
   - Rate ..... 7.0 gpm. of 50% Sodium Hydroxide, 90 gpm. of dilution water
   - Concentration ..... 5.6% NaOH by weight
   - Amount ..... 1,340# of NaOH
3. Rinse
   - Rate ..... 100-150 gpm.
   - Duration ..... 40 minutes
   - Volume ..... 4,000-6,000 gal.

Processing Regeneration Wastes

The ionized materials extracted from the plating rinses by the resins are discharged into the waste treatment system when the ion exchange units are regenerated. The regeneration procedure is given in Table 2. For the regeneration wastes there are two separate treatment systems, one for the cation wastes with auxiliary treatment to reduce all the chromates, and the other for anion wastes with auxiliary treatment to oxidize the cyanides (Fig. 4).

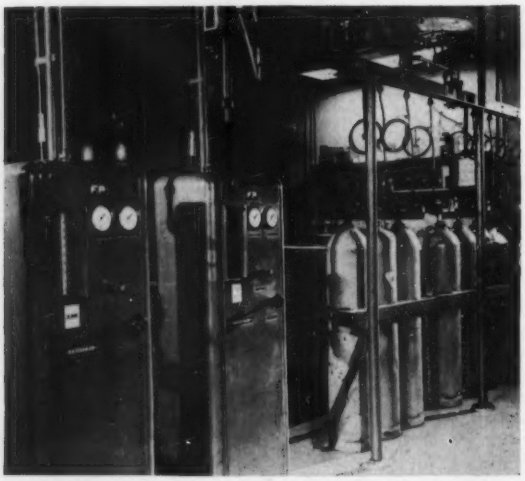

Fig. 4. Regeneration wastes from the ion exchange units are treated with chlorine and sulfur dioxide as part of the waste treatment process.

Fig. 5. Instrument panel provides complete picture of pH, conductivity, totalized flow, and feed pressures in the waste treatment process.

The alkaline regeneration wastes from the anion exchange unit are collected in 8500-gal tank where the cyanides are oxidized by reacting them with injected liquid chlorine to form carbon dioxide and nitrogen oxides, which are vented from the tank. Approximately 7 lbs. of chlorine are used per pound of cyanide, based on prior analysis of the waste solution. The reaction is conducted at a pH of 8.6 or above to prevent the formation of nitrogen trichloride, a dangerously unstable gas, and the tank is continuously agitated with compressed air to prevent the accumulation of local concentrations of chlorine where the pH might be reduced below safe levels. During the reaction the alkaline wastes are continuously recirculated through an external pipe loop to improve mixing and permit the handling of higher concentrations of cyanides with faster addition of chlorine safely. The pH in the recirculating line is continuously monitored by a controller which automatically cuts off the chlorine feed when the pH drops below 8.8 (Fig. 5).

The acid wastes from the cation resin regeneration are treated in a 12,000-gal. tank by the addition of gaseous sulfur dioxide which reduces the hexavalent chromium to the trivalent form. The low pH (about 1.5 keeps the trivalent chromium in solution until the waste is transferred to the neutralizing tank.

As the last step of the treatment process, the alkaline regeneration wastes, free of cyanide, and the acid regeneration wastes containing dissolved trivalent chromium are combined in a 16,000-gal. waste neutralizing tank. Here the two solutions neutralize each other and, at the approximately neutral pH, the trivalent chromium precipitates and settles as a sludge to the bottom of the tank for later removal. Either acid or caustic is added to the neutralizing tank by an automatic control system, as required to effect complete neutralization of the solution. The effluent

from the neutralizing tank is discharged after being diluted 1 part to 8 with the effluent from the plant's industrial sewage system. The discharge stream is analyzed for cyanide, hexavalent chromium, copper, zinc, cadmium, nickel, and silver as well as soluble and suspended solids (Fig. 6). Except for cyanide and chromium, which are not present, the concentration of dissolved heavy metals in the discarded solution is well under 1 part per million, in accordance with the standards of the Tennessee Water Control Board (Fig. 7). These heavy metals are present in only minute quantities because the plated parts are allowed to drain over the plating tanks before being rinsed, and because of the very large dilution factor in the waste treatment process.

Supplementary System

To permit disposal of concentrated dump solutions without the necessity for dilution to reduce dissolved solids below 200 ppm., the limit of the equipment in the present system, a supplementary waste treatment system is now being installed. The new system will handle rinse water and dump solutions from chromium and cyanide plating baths exclusively, and is designed for continuous operation. The present ion exchange system will continue to be used for all other rinse water and dump baths. There will be an additional 15,000-gal. clarifier where all the heavy metals in the chromium and cyanide waste solutions will be precipitated by reaction with lime.

The supplementary waste treatment facilities will consist of separate systems for handling chromium and cyanide wastes on a continuous basis. As previously, the chromium will be reduced from the hexavalent to the trivalent form by sulfur dioxide, preparatory to precipitation in the clarifier. The chromium rinse water and dump plating baths will be collected in separate tanks to permit feeding the concentrated solutions at a slow rate and adjusting the pH more closely in the acid waste tank where reduction of chromium by sulfur dioxide is carried out. Similarly

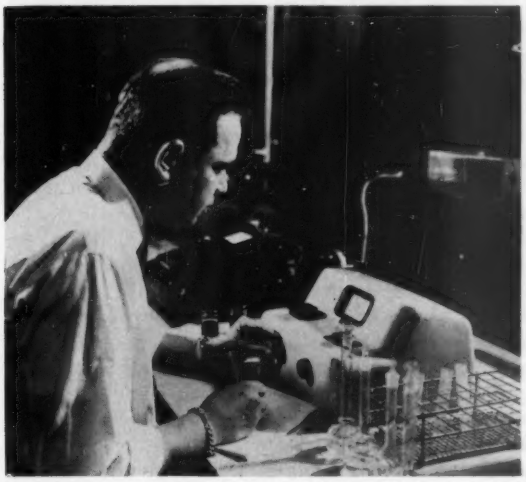

Fig. 6. Effluent from the waste neutralizing tank is sampled at frequent intervals and analyzed for heavy metals and soluble and suspended solids. Concentration of these materials is well below 1 ppm.

Fig. 7. Cheerful goldfish attest to the effective removal of all materials from the regeneration wastes. Effluent sample from the neutralizing tank, before dilution, is passed into fish tank as additional safety check before waste is discarded.

the cyanide rinse waters and dump plating baths will be segregated and pumped to the alkali waste tank where the cyanides will be eliminated by conversion to carbon dioxide and nitrogen by reaction with chlorine. The effluent from the alkaline waste tank will go to the clarifier unit for final disposal.

At the inlet to the clarifier unit the incoming waste solutions from the acid and alkaline waste tanks and from regeneration of the ion exchange units will be reacted with lime. This will precipitate the trivalent chromium and the heavy metals as hydroxides. Sludge will be drawn off continuously and pumped to a sludge pond. The overflow from the clarifier unit, which is designed for a 1-hour retention, will be filtered through a 210 sq. ft. sand filter to remove any light suspended solids that may carry over the weir. The sand filter will drain directly to a storm sewer. The effluent will be virtually free of heavy metals.

All three systems will operate continuously, with automatic control of pH at the critical points throughout. Conductivity and pH alarms in the line from the plating room sump will continuously monitor the solution concentration being fed to the ion exchange units. In case of a potential overload, the solution will be bypassed around the ion exchange units and pumped to the waste neutralizing tank and, from there, with properly adjusted pH, to the clarifier unit. During these intervals, the ion exchange units will receive an influent of raw city water to maintain continuous operation. The limitation on the capacity of the ion exchange system is due to the physical size of the equipment rather than the nature of the process. In other installations the entire plating waste load is handled by ion exchange. Feed rates through the three parallel systems will be set manually, but pH set manually will be maintained automatically.

The system engineering and ingenuity credits to *A. G. Feigler* of American Water Softener Co., Inc., Philadelphia, Pa.

Conversion Coatings

Phosphate Films

By Lester F. Spencer

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THE term "phosphate conversion coating" refers to an adherent surface layer that consists, in general, of insoluble metallic phosphates produced on metal surfaces by the action of a suitable balanced and controlled bath. These coatings, which are widely used on steel, zinc, aluminum and, to a lesser extent, on cadmium, tin, and magnesium surfaces, will alter the surface properties either in appearance, electrical resistance, surface hardness, electrochemical potential and/or absorptivity. As a result, these coatings are actively employed as:—(a) an agent to improve paint bonding; (b) a protective barrier against corrosion; (c) a decorative effect; (d) an aid to cold forming, as exemplified in deep drawing, extrusion and press forming; and, (e) as aid to increase lubricity of friction surfaces.

Phosphate conversion coatings may be classified not only by the type of metal phosphate film that is formed on the surface of the material protected, but also by the coating weight. Table 1 gives this relationship of end use to both the nature and thickness of the coating.

Mechanism of Coating Formation

Phosphoric acid itself has a corrosion inhibiting effect on steel surfaces and many of the earlier formulations were based on this acid type as the solvent, with additions of other compounds. Thus, the Coslett bath[16] used a phosphoric acid solution saturated with iron, with the time period of obtaining a coating ranging upward to 2½ hours or more. The Richards bath[14] employed manganese dioxide as a partial substitution of the iron addition in order to prevent the continual loss of iron in the Coslett bath, which was responsible for the lengthy immersion time required to obtain a satisfactory coating. This formulation did partially solve the problem of depletion of iron through oxidation; however, it introduced the need for close control in balancing free and combined phosphate constituents. This obvious disadvantage was overcome by the use of manganese dihydrogen phosphate[15] as a controlling addition in replenishing the bath. These crystals slowly decompose to liberate phosphoric acid[12] and provide a constantly balanced bath. Even with this bath, an average length of immersion to obtain a coating weight between 1000 and 2000 mg./ft.^{2} was about one hour.

Present day formulations to obtain crystalline phosphate coatings would include phosphoric acid as the solvent, metallic phosphate salts, and accelerators or oxidizers; the function of the latter addition being to speed up the reaction. Although a number of metal phosphate salts may be employed, i.e., calcium, strontium, cadmium, iron, zinc, manganese, and chromium, proprietary compounds usually contain metallic phosphate salts employing manganese, zinc, iron, or mixtures of these metals. One of the accelerators used was that of copper[12,17] which realized a reduction of processing time from one hour to about ten minutes. Further modifications which prevented a hydrogen film formation between the solution and the work reduced this time factor to five minutes.[18] Later, the time period was further reduced to two minutes[19] by increasing the concentration of the metal bearing salts within the bath.

The quality and type of phosphate coating is interdependent on a number of factors including the metal concentration, the accelerator type, and the pH of the solution. The present-day formulations, the details of which are very seldom found in the literature, seem to be on the basis of the accelerator type employed; the more common accelerators being the nitrates, nitrites, peroxides, and chlorates. They are used alone, in combination with each other, or with metallic as well as other organic and inorganic accelerators. A survey of the chlorate accelerated bath has been given by Heinzelmann,[2] who indicated that this bath type permits the growth of fine crystalline deposits with consequent low porosity of coating. The nitrate bath generally produces deposits that have a coarse crystalline structure, whereas, the nitrate, nitrite bath has the ability to produce a fine crystalline deposit; however, there are complications in balancing the solution. In general, all accelerators do not produce the same result nor are the optimum operating conditions the same for every bath. The pH would depend upon the type of heavy metal phosphate used and the soluble phosphate content of the solution with the specific oxidizing agent employed. Since pH control is quite important in preventing undesirable reactions to occur, acids other than phosphoric acid and/or certain buffers may be employed to control this variable easily. Details are seldom found in the literature although methods of control to obtain optimum performance are incorporated in various proprietary compounds.

The mechanism of film formation is not completely understood due to its complexity; however, attempts have been made to rationalize the reaction, based on the electrochemical theory. Thus, the first step upon the immersion of a material in a phosphate solution is the chemical attack on its surface at anodic areas. At the cathodic areas of this same surface, there is a reaction with the solution which reduces the acidity of the solution immediately surrounding these areas. Since metal phosphate solubility decreases as acidity decreases, the normal reaction is the precipitation of the secondary and tertiary phosphates and, depending upon the conditions of the bath, an adherent film will form over the entire surface to be coated. Due to the previous mentioned solution of iron from the immersed material, the deposited coating will invariably contain a substantial proportion of the insoluble phosphate of the treated metal. In those baths that contain either

TABLE I

Nature and Thickness of Coating as Related to the Purpose of Phosphating[13]

PURPOSE OF PHOSPHATING	NATURE AND THICKNESS OF COATING grams/square decimeter	
Increase in the corrosion resistance of the protective coating	$FeHPO_4$	0.003-0.006
	$FeHPO_4 + ZnHPO_4$	0.016-0.040
Increase in the corrosion resistance of the protective coating with zinc or cadmium as the basis metal	$ZnHPO_4$	0.016-0.040
For subsequent treatment by greasing or waxing of the coating	$FeHPO_4 + ZnHPO_4$	0.30
	$MnHPO_4 + FeHPO_4$	0.30
Protection against surface wear	$FeHPO_4$	0.30
	$MnHPO_4$	0.30
	$NiHPO_4$	0.30
Cold forming	$ZnHPO_4$	0.05-0.20 according to the degree of cold forming
	$FeHPO_4$	
Electrical insulation	$FeHPO_4$ $MnHPO_4$ $ZnHPO_4$	0.350 and over

Note:—Time for coating thickness of 0.325 g./dm.^{2} is from 15 to 16 minutes.

ammonium or sodium phosphates, the resultant phosphate coating will be composed entirely of an iron phosphate.

As mentioned previously, acceleration of the bath reaction is necessary to reduce the time period for the phosphate film formation. Thus, there is normally considerable hydrogen gassing, which serves as a barrier at the cathodic areas and, thus, prevents rapid deposition of the phosphate coating. The addition of an oxidizer will reduce this objectionable gassing action, eliminate its enveloping effect, and will permit a more rapid deposition of the phosphate film. Metals such as copper, which are cathodic to the dissolving iron, increase the solution rate of iron by depositing on the iron and forming local cells with it. Thus, a large number of sites for the nucleation of fine grained crystals are available, with the result that a rapid formation of a phosphate film will be realized.

Commercial Phosphate Conversion Coatings

The commonly used phosphate coatings contain zinc, manganese, iron, or a combination of these heavy metals. Identifying features of these coatings would include:

1. The iron phosphate deposit is a comparatively light crystalline coating with a film weight ranging from 50 to 100 mg./ft.^{2}, used to improve paint adhesion. The coatings are produced with a hot, dilute solution of either sodium or ammonium phosphate that is operated at a pH of 5.0 to 6.0. It usually does not lend itself to brush application and is primarily designed for spray type equipment. In addition, these coating baths may contain a detergent which permits the simultaneous function of cleaning and coating of the work.

2. The zinc-iron phosphate film may be deposited as a relatively lightweight coating with a weight up to about 150 mg./ft.^{2} A typical type would be an accelerated zinc hydrogen phosphate bath containing dihydrogen phosphate and phosphoric acid. Film formation is rather rapid while the protection given as an undercoat for paint is limited for applications where the corrosive environment is not too severe. A medium weight phosphate film of the above type, in which the weight would range from 100 to 700 mg./ft.^{2}, may also be used as a paint base for more severe corrosion environments. This coating, in conjunction with a suitable lubricant, will facilitate the cold mechanical deformation of steel. The heavy coating type, which weighs from 1000 to 4000 mg./ft.^{2}, is adapted to the retention of rust-inhibiting drying or non-drying oils and waxes on steel, providing both corrosion resistance and excellent frictional properties. This coating type may be used to increase the lubricity of friction surfaces and as an aid in cold deformation.

3. The manganese-iron phosphate coatings are of the heavy film type, weighing from 1000 to 4000 mg./ft.^{2} It is a heavy, black coating used on friction surfaces to prevent galling, scoring, and seizing of parts. Typical metal parts treated are pistons, piston rings, cylinder liners, camshafts, and tappets.

4. In contrast to the crystalline phosphate coatings discussed above, the amorphous phosphate coating has been formulated for the treating of aluminum base alloys. This coating, which is applied either by dipping or spraying, is hard, apparently non-porous, non-ab-

TABLE 2

Salt Spray Data on Phosphate Coatings of Weights Ranging from 0.02 to 0.05 g./dm.^{2}

Non-treated steel sheet	3 hours
Phosphate coating (steel) without lacquer	8 to 10 hours
Phosphate coating with grease application	50 hours
Phosphate coating with air-dry lacquer	100 to 150 hours
Phosphate coating with polymerized lacquer coating	200 to 2500 hours

sorptive, and incapable of being dyed or stained. The coating weight may range from 100 to 600 mg./ft.^{2}, and it is frequently used as a substitute for anodically produced coatings as a base for subsequent painting, or as a corrosion resistant film. A typical bath would consist of a mixture of chromic, phosphoric, and hydrofluoric acid to form what is believed to be a trivalent chromium and aluminum phosphate layer.

Film Characteristics of a Crystalline Phosphate Coating

As a pre-treatment for subsequent painting, one of the more important film characteristics is that of crystal size. Thus, to obtain both maximum corrosion resistance of the base coating and economy of paint consumption, it is necessary to have a fine crystal size. In other applications, where a relatively heavy coating is required, a coarser crystal size is almost a necessity, since growth is related to some extent to the length of time the part is immersed in the phosphating solution. Since crystal size is of considerable importance, details as to the effect of various factors that influence this characteristic will be given.

Surface preparation has a definite influence on crystal size. The first prerequisite is that the surface be clean to obtain a phosphating action. However, residues from solvent cleaning, vapor degreasing, or solvent emulsions have a tendency to refine the crystals[4] if present in extremely light films. Where an acidic film, or a film resulting from a caustic alkali cleaner, is present on the surface of the work-piece, the coating will largely be large phosphate crystals,[8,12] which is frequently referred to as "sparkle." However, where the alkali cleaner contains no free caustic, the resultant phosphate coating will be of moderate crystal size with the absence of "sparkle."

Streicher[20] is credited with discovering the "wipe effect," in which smooth coatings were obtained by using a mechanical wiping action over the surface of the work-piece prior to application of the phosphate coating. Thus, by using either a rag, solvent-wet cloth, or even the bare hand, it is believed that the inhibiting film deposited by the cleaning procedure is thereby removed and permits the deposition of a smooth, fine-grained phosphate deposit. It is for this reason that spray application is preferred over an immersion treatment[4] and, for similar reasons, higher pressures are preferred to lower spray pressures.

Several attempts to remove this inhibiting film has been made. Tanner[21] proposed the use of rubber coated rolls, which proved quite effective but was limited to flat sheets and coils. Later, Romig[22] proposed the use of oxalic acid as a pretreatment and, although it produced the fine crystalline deposit desired, the results were inconsistent due to the solution of iron in oxalic acid pretreatment. By far the most efficient pre-treatment was that introduced by Jernstedt,[23,24] who used disodium phosphate containing a small amount of titanium salt present as a colloid. He found that this pretreatment was more effective on zinc surfaces than on steel. Factors that effected the efficiency of this pretreatment included (a) instability of the activating agent under conditions of high temperature and high alkalinity and, (b) due to the colloidal nature of the activator, variation in efficiency was noted for products from different sources and different water conditions. However, it is generally agreed[4,8] that an activation treatment is necessary in an immersion type phosphate bath to obtain a fine crystalline deposit, since it does remove the inhibiting film.

Although iron phosphate coatings will invariably be fine-grained under almost any conditions, a difficulty that may be experienced is that the coating may be very loose and powdery. Thus, using an analogy of loose rust, a loose, powdery phosphate coating may be equally detrimental to good paint adhesion, this being particularly true where a one-coat paint system is employed.

A factor that is related to crystal size is the resistance to bending and impact. Thus, a phosphate coating not only should prevent blistering and under-cutting of the paint film but, also, it should not decrease the flexibility of the paint film. Resistance to both bending and impact is reduced as the amount and the coarseness of the deposited phosphate coating increases.

Amorphous Phosphate Coatings

Untreated surfaces of aluminum and its alloys possess no natural affinity for paint, lacquer, or enamel coatings. Because of the reactivity of the basis metal, such finishes will not adhere permanently and, after a comparatively short time, the coating will flake and blister. Various acid and alkali treatments etch the surface and provide an initial adhesion of a paint film; however, since the paint is still applied over an active surface, subsequent penetration of moisture through the paint film will cause difficulties in retaining adhesion of the finish coating. Anodizing procedures are successful, but the treatment requires elaborate equipment. A simple dip or spray application would be ideal on the basis of economics.

A number of proprietary compounds are available that will realize a phosphate coating believed to be composed of aluminum and trivalent chromium phosphate compounds. This coating exhibits excellent paint adhesion and, as a final coating, has good corrosion resistance, particularly to bimetallic or galvanic environments. Since the crystallinity is too low to be detected either by electron diffraction or x-ray technique, these coatings are frequently designated as amorphous deposits.[8] A bath employed consists of an aqueous solution of phosphoric, chromic, and hydrofluoric acids, and may contain other elements such as boron, silicon, zirconium, and titanium.

One formulation involves the following steps in the production of an immersion coating, namely: — (a) cleaning of work by immersion in a mild, inhibited alkaline cleaner, by solvent immersion cleaning or by vapor degreasing; (b) immersion in the phosphate solution at a temperature of 115°F. for 1 to 2 minutes; (c) rinse in cold water; (d) immersion in a sealer operating at a temperature of 100 to 120°F.; and, (e) thorough drying before painting. In this particular process, the weight of the coating increases with processing time, bath strength, and bath temperature. The latter is effective only up to a critical temperature value, and an actual reversal is realized at a temperature between 130 and 140°F. Very little is known about the electrical resistance of these coatings; however, it

is generally conceded that the resistance increases as the coating thickness increases.

Phosphate Coatings as a Paint Base

Zinc phosphate coatings ranging in weight from 200 to 800 mg./ft.^{2} frequently are used as a protective film for subsequent finishing. This weight range provides sufficient resistance to moderate and severe applications in the coating of iron, steel, zinc, and cadmium surfaces. The previously discussed amorphous phosphate coating serves equally as well on aluminum base alloys.

A special phosphate treatment is available for touch-up on magnesium to form a medium to dark gray film. Application may be either by brush, spray, or immersion, with a time varying up to 2 minutes, depending upon the method of application. A typical solution[11] would consist of an aqueous mixture of 16 oz./gal. ammonium acid phosphate, 4 oz./gal. ammonium sulphite, 2 fl. oz./gal. concentrated ammonia, and 8 to 20 fl. oz./gal. denatured alcohol. Methyl alcohol may also be used but it is more toxic. The alcohol content is dependent upon the extent of soil on the surface of the part; an increase of soil requires an increase in the alcohol content. The resultant film produces a consistent paint base and is less critical and safer to apply than the standard chrome pickle.

Phosphate coatings in weight ranges up to 120 mg./ft.^{2} are also used as a paint base; however, it is recommended for products that are exposed to light service conditions. The iron phosphate deposits are used quite frequently, but care must be taken that a loose, powdery coating is not obtained. A zinc phosphate coating within this weight class is normally applied on sheet and strip products at the mill, and has sufficient ductility to permit press forming without rupture of the film prior to paint application.

Phosphate Coatings for Corrosion Resistance

Phosphate coatings treated with a supplementary film of oil or wax will provide considerable corrosion resistance. The iron phosphate bath was one of the earlier types used. Due to the length of time required to obtain the required deposit thickness, however, which ranges from 2 to 2½ hours, the zinc and manganese phosphate baths are now employed. The zinc phosphate coating may be applied in 30 to 45 minutes, whereas, the manganese phosphate coating requires from 45 to 90 minutes. The weight of these coatings are usually from 800 to 2500 mg./ft.^{2}

All of these coatings are produced by the immersion process by simply dipping clean parts into the processing bath for the required length of time. The weight of the protective coating is a function of the specific bath composition used, the base analysis of the part coated, the immersion time, and the pretreatment given to the part processed. To obtain maximum corrosion resistance, a sealing rinse in a hot aqueous solution of chromic acid or a mixture of chromic and phosphoric acid (0.05 to 0.4 oz./gal.) is used after phosphating. The mixed acid bath is preferred since it reduces staining. An oven dry-off or compressed air blow-off is frequently used to reduce staining and streaking.

Phosphate Coatings to Aid Cold Forming

In the drawing of metals, considerable friction is realized between the work and the forming tools; the usual method to minimize friction being the use of a lubricant. These lubricants have not always been successful since, on severe forming operations, there have been occasions where this lubricant film ruptures, exposing the surface to scoring and even breakage.

The use of a phosphate coating in conjunction with a lubricant has been found to provide even greater protection than a lubricant where excessively high pressures are experienced during the forming operation. As a result, these coatings are used in deep drawing, cold heading, wire and tube drawing, and extrusion of steel, zinc coated steel, stainless steel, aluminum, and zirconium. It has been found that, due to the adherent coating which is sufficiently flexible to iron out as the forming procedes, a number of additional advantages may be realized. Thus, the reduction of friction permits less wear on tool components, increases both drawing speed and reductions per draw or pass, and reduces process anneals along with accompanying pickling operations. In addition, the surface is frequently freer from scratches and scoring which reduces subsequent finishing costs.

The immersion process is generally used for articles that will be subjected to heavy pressures in either extrusion or press working. The material should be clean and, in instances where extreme cold reduction is contemplated, a pickling operation along with suitable rinsing, regardless of the scale condition on the surface of the work. Lubrication follows phosphating and, depending upon the part treated, a hot air dry-off may be required. The spray coating is applicable in the forming of carbon steel in the manufacture of bath tubs, washing machine parts, and bumper bars.

Of the phosphate coats available, the zinc phosphate film is the most widely used due, partially, to its ability to react with some types of lubricants. The most widely used lubricant is soap which is absorbed by or reacts with the coating. The combined phosphate and soap film act as individual lubricants during a cold deformation process.

Phosphate Coatings to Reduce Wear

Various materials and methods are employed to reduce wear on bearing surfaces. Although differences of opinion exist as to the specific method, it is usually agreed that it is essential to maintain an oil film between the moving parts, and, thus, avoid metal-to-metal contact if serious wear is to be avoided. Phosphate coatings will serve well in reducing wear on bearing surfaces and, in addition, this non-metallic oil absorptive coating permits rapid "break-in" of new parts.

Manganese phosphating solutions are normally used for this application, with weights ranging from 1000 to 4000 mg./ft.^{2} Relatively clean parts are phosphated by immersion in a hot (200-210°F.) bath for a period of 10 to 30 minutes. The coating produced holds a uniform film of oil on the bearing surfaces as long as it lasts. Even after the coating has worn off, there will be small pits etched into the bearing surface that act as small oil reservoirs. Growth of 0.1 to 0.15 mil may be obtained by adjusting bath acidity and controlling the use of metal activating agents.

(To be continued. References will appear at end of series.)

*Immersion Plating on Zircaloy-2

By Leonard R. Kohan, *Armour Research Foundation of Illinois Institute of Technology, Chicago 16, Ill.*

THE object of this program was to deposit a uniform coating of a desired metal (e.g. copper, iron, tin, and nickel) on Zircaloy-2 (1.5% Sn, 0.12% Fe, 0.10% Cr, 0.05% Ni, balance Zr). Electroplating could not be utilized since the thickness of such a coating would be expected to vary considerably over 4 to 6 ft. flat sections. Immersion plating, if possible, would provide a method of obtaining a uniform coating, easily controllable to the desired specification of ±0.03 mil.

Prior to the commencement of the program at Armour Research Foundation, work at Westinghouse Atomic Power Division (Bettis Plant) led to the formulation of various immersion baths involving hydrofluoric acid. Among the metals deposited were copper, iron, tin, and nickel.

*Work performed under U.S.AEC contract AT-11-1-GEN-14.

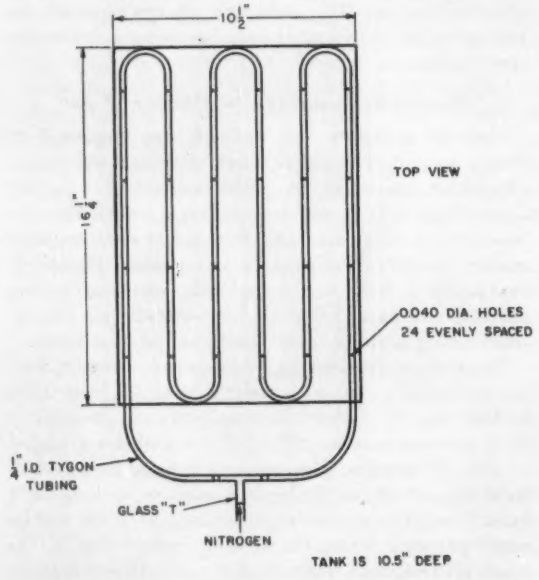


FIG. 1 - SCHEMATIC OF GAS AGITATED PLATING TANK ILLUSTRATING THE CONFIGURATION OF TUBING CONTAINING OUTLET ORIFICES.

Generally, immersion coatings are of the order of one or two atoms in thickness. In the replacement plating of Zircaloy-2 the deposit is quite porous, thus allowing an appreciable buildup in thickness. Surprisingly, adhesion is quite good. This may be due more to mechanical bonding than to chemical bonding, since the Zircaloy becomes somewhat etched during the plating process.

Theoretically it should be possible to immersion deposit any metal more noble than zirconium; however, only selected metals were investigated.

Pretreatment

Since the condition of the surface to be plated affects the uniformity of the coating to a great extent, a method of pretreatment was formulated from which reproducible surface conditions could be obtained. The method employed was as follows:

(1) Vapor blasting with 350 grit material.
(2) Cathodic electrolytic cleaning in a suitable proprietary alkaline cleaner.
  (a) Concentration — 45 g./l.
  (b) Temperature — 88°C.
  (c) Current density — 100 amp./ft.^{2}
  (d) Time — 1 minute
(3) Water rinse
(4) Pickling
  (a) Composition — HF (48%) ..... 1 part
  HNO_3 (conc.) ..... 9 parts
  H_2O ..... 10 parts
  (b) Temperature — room (approx. 78°F.)
  (c) Time — 30 seconds
(5) Water rinse
(6) Immersion plate

Copper Immersion Plating

Preliminary research had formulated a bath for the displacement plating of Zircaloy-2 by copper. The composition of this bath was:

$Cu(NO_3)_2 \cdot 3H_2O$	50 g.
HF (48%)	7 ml.
H_2O	1 l.

Operated at room temperature, with air agitation, the solution produced a coating which was acceptable

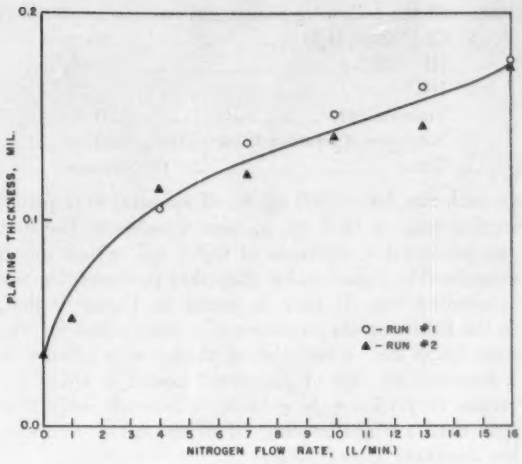


FIG. 2 – EFFECT OF AGITATION ON IMMERSION PLATING THICKNESS IN A COPPER BATH

BATH TEMPERATURE = 100°F
IMMERSION TIME = 15 MINUTES
HF CONC. = 2.5 ML/L

in appearance. It was found that thickness control was somewhat difficult. Therefore, the HF concentration was reduced to 2.5 ml./l. of H_2O. Copper thickness became much easier to control with this change.

Once an acceptable immersion copper bath was found, it became necessary to determine what effects were introduced by changing bath variables, such as agitation, temperature, hydrofluoric acid concentration, pH, and cupric ion concentration. For this study, a tank was constructed which would provide uniform agitation. Figure 1 shows the geometry of the tank used for the investigations. The first variable to be investigated was agitation. After pretreatment as previously discussed, two runs were made with the flow of nitrogen gas varied between 0 and 16 l./minute. Five specimens of Zircaloy-2, measuring 1" x 2⅜" x 0.40", were plated simultaneously in each run. Three of the specimens were used for gravimetric thickness determinations, and the remaining two were kept for possible further use.

Average plating thicknesses for each change in agitation are plotted in Figure 2. Uniformity between specimens was quite good, with optimum uniformity observed between 7 and 10 l./minute flow rate.

Copper thickness varied considerably in the 15 minutes of plating, depending upon the amount of agitation. When no agitation was present, a thickness of only 0.034 mil was obtained; at a flow of 16 l./minute, 0.176 mil of copper was deposited.

Preliminary studies indicated that higher bath temperatures increased the rate of immersion copper deposition. In order to determine the exact relationship of solution temperature to plating rate, a series of tests was run in which the copper bath temperature was raised from 80° to 130° in 10°F. intervals. Agitation and HF concentration were kept constant at 10 l./minute of gaseous nitrogen and 2.5 ml./l. HF, respectively. Pretreatment was, of course, identical to that described. Three separate runs were made, with a fresh bath used for each run.

Results are shown in Figure 3. It is seen that the relationship between plating thickness and bath temperature is linear. A total difference of 0.05 mil was caused by raising the bath temperature from 80° to 130°F., with a plating time of 15 minutes. These experiments indicate that small variations in the bath temperature would cause no drastic changes in the rate of copper deposition.

Since such small changes in copper thickness were observed with changes in temperature, 100°F. was chosen for all further studies, as this temperature would be convenient in production. If a lower temperature were to be used, cooling would most likely be necessary during hot weather. Heating, of course, involves fewer problems than refrigeration. Maintaining 100°F. would entail very little in the way of heating capacity in large production facilities.

The HF level has a very great effect on the rate of copper deposition. For this study, temperature and gaseous nitrogen agitation were kept constant at 100°F. and 10 l./minute of wet nitrogen, respectively. The HF concentration was varied from 1 to 5 ml./l. Using a fresh bath for each run, three test runs were made. Results are given in Figure 4.

It can be seen in Figure 4 that a very rapid increase in the copper plating thickness occurs with small increases in the concentration of hydrofluoric acid. The slope of the curve drops somewhat as the HF level approaches 4 ml./l. This may be the result of the heavier coating of copper stifling the replacement re-

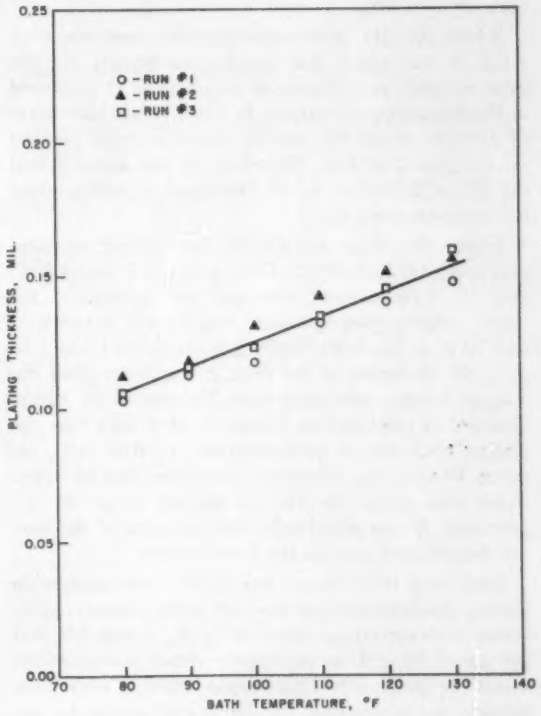


FIG. 3 – EFFECT OF TEMPERATURE ON IMMERSION PLATING THICKNESS IN A COPPER BATH

IMMERSION TIME = 15 MINUTES
N_2 AGITATION = 10 l/MIN
HF CONC. = 2.5 ML/LITER

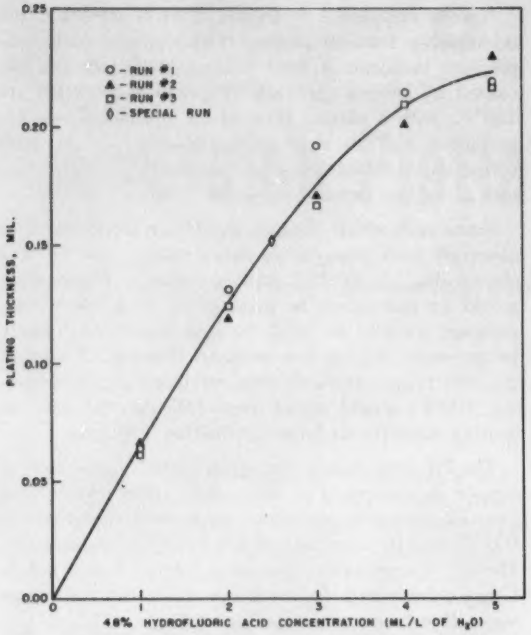


FIG. 4 - EFFECT OF HYDROFLUORIC ACID CONCENTRATION ON IMMERSION PLATING THICKNESS IN A COPPER BATH

BATH TEMPERATURE = 100°F
IMMERSION TIME = 15 MINUTES
N_2 AGITATION = 10 L/MIN

action.: In each of the three runs the copper thickness was well within the ±0.03 mil tolerance expected for each level of HF.

When the HF concentration was used above 4 ml./l. it was noted that the copper deposit did not present quite as uniform an appearance as produced at the lower concentrations. In some cases, bare areas of Zircaloy about the size of pinheads could be seen on the plated surface. Therefore, it was decided that the HF at 2.5 ml./l., in all likelihood, would produce the optimum coating.

Under the same conditions for plating as used previously (i.e., 100°F., 15 minutes, 2.5 ml. HF/l., and 10 l./minute of nitrogen for agitation), the cupric nitrate concentration was varied between 5 and 70 g./l. When the $Cu(NO_3)_2{\cdot}3H_2O$ level was 5-10 g./l., the thickness of the deposit was lower than the average for the remaining runs. The plot of the values obtained is presented in Figure 5. It is seen that the plating thickness is quite constant (±0.02 mil) between 30 and 70 g. of cupric nitrate per liter of water. Below this range the rate of plating drops off appreciably. It was also found that adhesion of the copper deposit was poor at the lower values.

Since very little change was noted in the immersion plating characteristics of the bath at the various cupric nitrate concentrations above 30 g./l., it was felt that the use of 50 g./l. as the cupric nitrate concentration would be preferred. This would allow a very wide latitude in controlling the bath and would be the minimum level needed to provide an adequate safety factor.

For the final study of the immersion copper plating process, large sheets of Zircaloy-2 were plated in a bath with the following concentrations and conditions:

$Cu(NO_3)_2{\cdot}H_2O$	50 g.
HF (48%)	2.5 ml.
H_2O	1 l.
Temperature	100°F.
Nitrogen Agitation Flow	10 l./minute
Time	60 minutes

In each run 100 to 200 sq. in. of material were plated until a total of 1271 sq. in. were processed. The first run produced a thickness of 0.359 mil, which was a considerably higher value than that produced by any succeeding run. It may be noted in Figure 6 that, in the final run, the thickness of copper deposited was only 0.055 mil. When plating thickness is plotted as a function of area of Zircaloy-2 plated, a sharp decrease in thickness is evident, with each additional run, until a slight leveling off of the curve occurs as the thickness nears 0.10 mil.

Determinations were also made on the actual amount of copper deposited from the bath. Figure 7 shows the relationship between immersion copper plating thickness and depletion of copper concentration in the plating bath. Since the solution originally contained 197.5 g. copper metal, and 30 g. were deposited at the end of the test, only 17.7% of the available copper was used.

While it appears that the effectiveness of the bath has practically ceased when only 17.7% of the copper has been removed, plating rate can be increased through the addition of HF. It is thought that this addition does not truly rejuvenate the bath, but rather raises the HF concentration so as to increase the rate of deposition for a given time. Once additional work is processed through this solution, results similar to those in Figure 6 are evident.

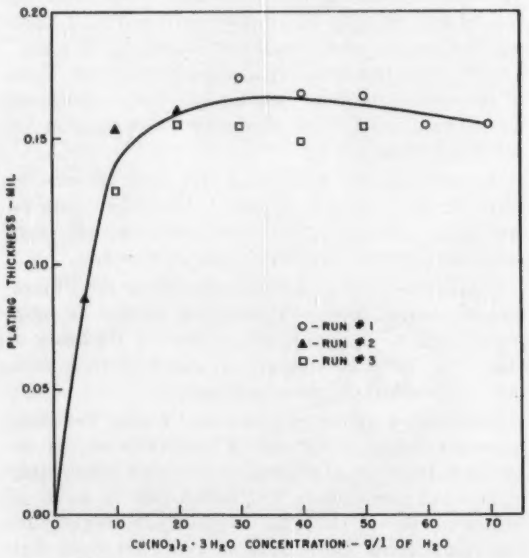


FIG. 5 - EFFECT OF CUPRIC NITRATE CONCENTRATION ON IMMERSION PLATING THICKNESS IN A COPPER BATH

BATH TEMPERATURE = 100°F
IMMERSION TIME = 15 MINUTES
N_2 AGITATION = 10 L/MIN
HF CONC. = 2.5 ML/L

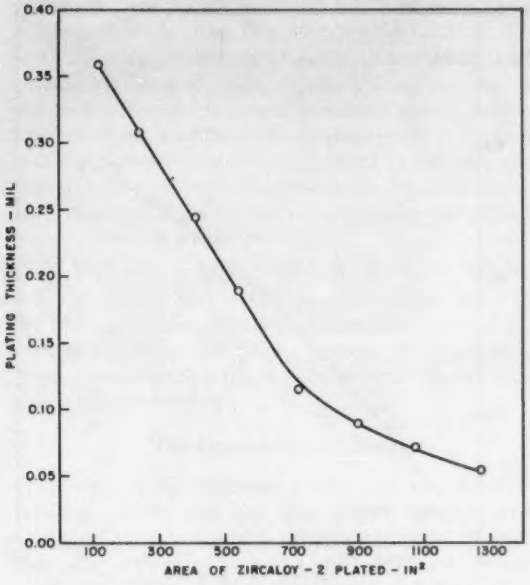


FIG. 6 – EFFECT OF QUANTITY OF ZIRCALOY 2 PLATED ON IMMERSION PLATING THICKNESS IN COPPER BATH

BATH TEMPERATURE = 100°F
IMMERSION TIME = 15 MINUTES
N_2 AGITATION = 10 l/MIN
HF CONC. = 2.5 ML/L

At the completion of the study of the effect of depletion of copper, a white precipitate was found in the bottom of the plating tank. This precipitate was analyzed spectrographically and found to be ZrO_2 with minute amounts of Al, Cu, Mg, Ni, Sb, Si, and Zn. The analysis showed the precipitate to contain 36.9% Zr and ZrO_2.

In the studies of the different variables, pH measurements were made as a matter of course during each run. Changes in pH were found to be insignificant in all cases except the depletion studies. There, the pH dropped from 1.61 after the first run to 1.08 after the eighth. Generally, though, such a changes in pH should not have much effect, if any, on the general plating process.

From the data and experimental work it is evident that immersion copper plating on Zircaloy-2 can be carried out in production facilities without fear of major difficulties in controlling the process. While it is true that the life of the bath may be somewhat limited due to the buildup of dissolution products of the Zircaloy, this should not prove to be a great deterrent when considering the uniformity of the immersion coating process and the ease of thickness control. Life of the bath can be extended by the addition of HF as work is processed.

The actual chemical process of plating probably involves two main reactions, the first being the actual replacement of the zirconium by copper:

$$Zr + 2Cu(NO_3)_2 + 6HF \rightarrow 2Cu \rightarrow H_2ZrF_6 + 4HNO_3$$

and the second being the further reaction of the H_2ZrF_6 complex with water:

$$H_2ZrF_6 + 2H_2O \rightarrow ZrO_2 + 6HF$$

Thus, it can be seen that there is no loss of HF during the process, but rather a "tying up" of the fluoride ion in the formation of the ZrF_6 complex ion, which is readily soluble in the bath. Of course, as additional Zircaloy-2 is plated, more zirconium is dissolved in the bath and the concentration of zirconium ion increases. It was found that the Zr concentration was 2.1 g./l. after the depletion studies.

In a replacement plating process the efficiency generally decreases as the concentration of dissolution products increases. With the immersion copper bath, some of the dissolved zirconium is removed as a ZrO_2 precipitate; but very little of the oxide is formed when compared to the amount of zirconium being replaced. The increase in the zirconium concentration is probably the primary cause for the reduction in the copper deposition rate.

Iron Immersion Plating

Early in the program attempts were made to immersion plate iron with the following bath:

$FeCl_2 \cdot 4H_2O$	50 g.
$CH_3CHOHCOOH$ (lactic Acid)	10 ml.
HF (48%)	7 ml.
H_2O	1 l.

A covered, high temperature polyethylene tank heated by a 2 KW tantalum-sheathed heater was used. Temperature was kept constant at boiling. This also provided vigorous agitation. With this bath the dissolution of Zircaloy-2 proceeded at a much faster rate than would normally occur for the replacement process. Very heavy pitting of the samples was encountered and the coating had a coarse appearance.

In an attempt to improve the immersion iron plating

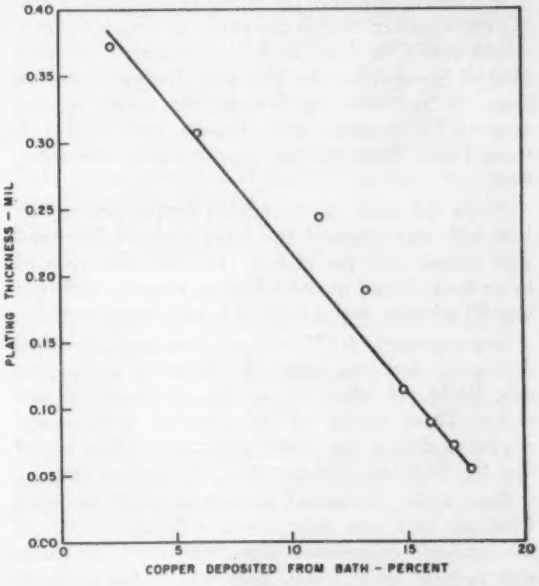


FIG. 7 – RELATIONSHIP OF IMMERSION PLATING THICKNESS AND DEPLETION OF COPPER CONCENTRATION

BATH TEMPERATURE = 100°F
IMMERSION TIME = 15 MINUTES
N_2 AGITATION = 10 l/MIN
HF CONC. = 2.5 ML/L

process another bath composition was prepared:

$FeCl_2 \cdot 4H_2O$	50 g.
$CH_3COONa \cdot 3H_2O$ (sodium acetate)	10 g.
HF (48%)	2.5 ml.
H_2O	1 l.

Once again, temperature and agitation were maintained by boiling. By means of this solution, the severe etching was eliminated and an adequate iron plating rate was achieved (see Figure 8).

Since the plating operation is accomplished at boiling, it became obvious that this might present a problem in production. Therefore, attempts were made at lowering the plating temperature. Coupons were immersed for plating at 140°F. and 170°F. Very thin spotty coatings resulted. These were inadequate in thickness and uniformity for diffusion bonding operations. Further attempts to lower the immersion iron plating temperature for the ferrous chloride bath were therefore suspended.

Since it had been shown that the plating variable having the greatest effect on the deposition rate was hydrofluoric acid, this was the next study made. Varying the HF concentration from 1 to 5 ml./l. produced dramatic differences in the rate of iron deposition. The plating rate rises rapidly with each addition of HF until a concentration of 4 ml./l. is reached. With the next addition a slight drop in plating thickness is noted.

There are two possibilities for the decrease in the plating rate: the heavier coatings mask off the zirconium from the replacement reaction, or etching of the plate results in dissolution of some of the immersion-plated iron. In either case it does not seem practical to use an HF concentration greater than 4 ml./l.

In order to minimize the effects of evaporation during the determination of the effect of ferrous chloride concentration, a fresh bath was prepared for each level of ferrous chloride. This also eliminated possible losses of hydrogen ion through the formation and evaporation of acetic acid. Results were similar to those found when varying copper nitrate concentration.

As in the study of immersion copper plating, an iron bath was prepared and large areas of Zircaloy-2 were plated until the plating rate had been reduced to an insignificant amount. Plating time for each run was 30 minutes, and a total of 8 runs were made.

Approximately 0.221 mil of iron was deposited during the first half hour. The thickness dropped to only 0.038 mil after 920 sq. in. of Zircaloy-2 was plated. These results are quite similar to those encountered during the copper depletion studies, except that the thickness does not level off quite as fast.

Once again, the actual amount of metal deposited from the bath was determined. Although 17.7% of the available copper was deposited before the thickness became insignificant, only 6% of the available iron was reduced from the bath. It is obvious that the effectiveness of the bath has virtually ceased when only a small portion of the available iron is used. As in the copper process, an addition of HF to the bath will result in an increase in the plating rate.

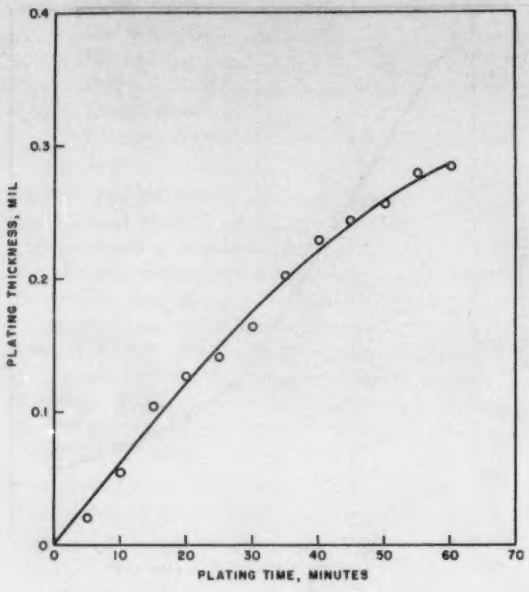


FIG. 8 – IMMERSION PLATING RATE IN BOILING IRON BATH

After extensive experimentation and actual iron plating of receptacle sheets, the feasibility of the immersion iron plating process has been established. The problem of control is somewhat greater here than in the case of the 100°F. copper bath, but is not insurmountable. For laboratory work, a lid was used with the high-temperature polyethylene tank. This cover was concave, thus allowing cold water to be circulated in it and, in effect, forming a condenser to prevent evaporation. Since the cover did not form a tight seal, some evaporation did occur.

Another difficulty encountered was in drying after plating. If the plated sample was allowed to remain wet for a few minutes after removal from the plating tank, it would begin to rust. To stop the formation of rust, samples were quickly water rinsed and placed in a tank containing absolute alcohol. They were then removed and dried by means of a hot-air dryer. After drying, they were carefully wrapped and placed in a desiccator. Once this drying method was introduced, rusting ceased to be a problem.

An attempt was made to immersion plate iron on Zircaloy-2 using a bath in which ferric chloride replaced ferrous chloride. The only result of this experiment was a slight etching of the Zircaloy-2 without deposition of any iron.

Another composition that was tried in the search for a low-temperature immersion iron plating process was:

$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$ (ferrous ammonium sulfate)	100 g.
$CH_3COONa \cdot 3H_2O$ (sodium acetate)	15 g.
HF (48%)	2.5 ml.
H_2O	1 l.

At temperatures up to 140°F., a maximum of 0.05

mil of iron was plated. Since this thickness was clearly insufficient for brazing, this study was terminated.

The plating reaction is probably somewhat similiar to that in the immersion copper plating process. It was noted that the free acid remained quite constant after dropping slightly at the beginning. It is thought that this decrease is most likely caused by the evaporation of acetic acid which forms in the bath. If this is true, there would be no loss in acid during the plating and the reaction might be:

$$Zr + 2FeCl_2 + 6HF \rightarrow 2Fe + H_2ZrF_6 + 4HCl$$

Very often, a dark brown precipitate was found in the plating solution. Analysis showed it to be 66.44% iron as $Fe(OH)_3$ and Fe_2O_3. In some instances, little or no precipitate was found to be present. No explanation is offered for this.

Tin Immersion Plating

Another of the materials studied for the diffusion bonding process was tin. The plating solution first developed produced a very heavy coating which was flaky and crystalline in appearance, with poor bonding. Composition of this solution is as follows:

$SnCl_2 \cdot 2H_2O$	50 g.
$CH_3CHOHCOOH$ (lactic acid)	10 ml.
HF (48%)	7 ml.
H_2O	1 l.

Plating was performed at room temperature with air agitation.

Since a deposit of 0.2 mil was desired for diffusion bonding, this bath was found to be inadequate due to difficulty in thickness control. It was found that 0.2 mil would be deposited from the bath in approximately 8 minutes.

In order to reduce the rate of tin deposition, the concentration of HF was reduced to 1 ml./l. With this bath, 0.30 mil of tin was plated in 30 minutes. The tin was once again flaky and crystalline, but bonding had improved and the coating was satisfactory for preliminary diffusion bonding studies to determine the feasibility of using tin.

Further studies in immersion tin plating for diffusion studies led to the formulation of the following solution:

$SnCl_2 \cdot 2H_2O$	50 g.
$CH_3COONa \cdot 3H_2O$ (sodium acetate)	10 g.
HF (48%)	2.5 ml.
H_2O	1 l.

Air agitation and a temperature of 205°F. were used.

The deposit produced was crystalline in appearance and quite adherent. It could only be removed by scraping with a sharp object. Previous coatings could be removed by mildly abrading the surface. Plating thicknesses of 0.20 mil were produced in 30 minutes.

Nickel Immersion Plating

Experimentation at Westinghouse had produced a bath from which nickel could be immersion-plated onto Zircaloy-2 in the thicknesses of approximately 0.2 mil. Using this solution, research at ARF began with studies as to the uniformity and reproducibility of thickness of the nickel coating.

The plating conditions used are as follows:

(1) Composition —

$NiCl_2 \cdot 6H_2O$	50 g.
$CH_3COONa \cdot 3H_2O$ (sodium acetate)	10 g.
HF (48%)	4.0 ml.
H_2O	1 l.

(2) Temperature — Boiling (to provide both agitation and constant temperature)

(3) Time — 35 minutes

(4) pH — 4 to 5

With the above plating bath, the deposition of nickel is quite rapid during the first few minutes but, after 20 minutes, the rate is reduced considerably. After approximately 40 minutes the deposition virtually ceases, although not entirely.

In order to determine the uniformity of coating thickness, standard size plates of Zircaloy-2 were nickel-plated for various lengths of time in the violently agitated, boiling plating bath. Actual weights of nickel deposits at selected areas over the plate surface were determined on the electrolytic thickness tester,* which strips the plating at a given current density, and by the gravimetric method. From this, thickness was computed on the basis of a 100% dense deposit.

Results of the uniformity checks showed the variation in the thickness over the surface to be no more than ± 0.03 mil, and in most cases less.

Since the operation of a boiling immersion nickel plating bath might involve certain difficulties in production, an investigation was made using the present bath at lower temperatures, with air agitation to provide stirring of the solution. At temperatures of 140° and 170°F., coatings were quite thin, even after considerable plating time, and were therefore inadequate for diffusion bonding.

Another attempt to lower the plating temperature was made by revising the solution composition as follows:

$Ni(NO_3)_2 \cdot 6H_2O$	50 g.
HF (48%)	2.5 ml.
H_2O	1000 ml.

With air agitation and at room temperature no nickel plated out of this solution.

*H. T. Francis, Electrochem. Soc., **93**, 79 (1948).

Summary

Four types of immersion deposits on Zircaloy-2 were investigated: copper, iron, tin, and nickel. Additional metals were not included in this study, although others may be deposited by the immersion processes.

Still another advantage of immersion plating may lie in providing a "strike" for subsequent electrodeposition on Zircaloy-2.

Acknowledgement

The author wishes to thank *Frank M. Cain* for his work in the formulation of the immersion plating process and the Westinghouse Electric Corp. and the United States Atomic Energy Commission for sponsoring the research program.

Electrochemical Society

Abstracts of Papers of Interest to Metal Finishers, presented at the Columbus, Ohio, Meeting of The Electrochemical Society, October 18-22, 1959.

Nitric-Hydrofluoric Acid Pickling of Zirconium Alloys

M. A. DeCrescente (*present address: CANEL, Middletown, Conn.*) P. F. Santoro, A. S. Powell, and R. H. Gale, *Materials Development Lab., Nuclear Div., Combustion Engineering, Inc., Windsor, Conn.*

The dissolution of Zircaloy-2 has been studied in the temperature range of 60°-100°F. in unagitated and agitated hydrofluoric-nitric acid solutions. The dissolution rate was found to increase with HF concentration and agitation. The energy of activation for the Zircaloy-2 pickling process compares very well to the value for the unalloyed zirconium pickling process, 3.3 kcal/mole. The energy of activation does not depend on agitation.

Electrolysis in Anhydrous Ether

I. E. Gillet, *Chef de Travaux, d'Electrochimie et de Chimie Organique Appliquee, Universite de Liege, 2, rue A. Stevart, Liege, Belgium.*

Electrolyses have been carried out on anhydrous ethyl ether made conductive by dissolution of inorganic salts or Grignard reagents ($AlCl_3$ or $AlCl_3$ + LiCl or $MgBr_2$ or RMgBr). Polarization curves have been determined and products analyzed. Results and conclusions are presented, the main conclusion being that ether itself reacts easily at both electrodes and is sometimes the only reacting substance, the dissolved salt being used only to conduct the current in solution.

Electropolishing in Chloride Solutions

E. B. Saubestre, *Enthone, Inc., A Subsidiary of American Smelting and Refining Co., 442 Elm St., New Haven, Conn.*

Solution formulas and operating conditions are presented which permit electropolishing of a wide number of metals and alloys in solutions containing chlorides. These solutions resemble the perchloric acid type of electropolishing solution in many respects. Outstanding feature of these solutions is the very wide range of current densities over which electropolishing occurs. These solutions are most useful for treating small parts.

Electrolyte for Deposition at —60°C.

H. B. Maier, *Bergen Labs. Inc., Clinton, N. J.*

An electrolyte which is liquid and conductive at —60°C. consists of ethanol, water, sodium sulfate, nickel sulfate, and additional inorganic and organic materials. The salts are dissolved in the water, and a large amount of ethanol (approximately 80% by volume) is added to form an electrolyte solution having a low freezing point. Conduction at —60°C., after running overnight, is 1.5 ma at 13 v for electrodes 1 $in.^2$ in area, 7/8 in. apart. The anode consisted of a strip of nickel, the cathode of a strip of copper. During removal of the electrolysis cell from the freezing unit, no gassing was observed. A small amount of black powder was seen on the cathode. Further tests are being conducted to obtain a uniform metallic coating at —50°C.

Anodic Films on Copper in Phosphoric Acid

J. H. Bartlett, *University of Illinois, Dept. of Physics, Urbana, Ill.*, and F. H. Giles, Jr., *University of South Carolina, Columbia, S. C.*

If initially a copper anode in phosphoric acid is in the steady state and if the current is then interrupted, break curves of the variation of voltage with time may be recorded. At the lower voltages, such curves decay in a manner resembling an exponential, and the convection layer disappears at the same time. If the voltage is just above the point corresponding to the knee of the current-voltage curve, there is superimposed on the above break curve a similar one with a much smaller time constant. This is what would be observed if concentration gradients in a much thinner layer were being ironed out. This time constant increases with voltage, indicating that the thickness does, also.

Polishing Regions for Copper in Phosphoric Acid

J. H. Bartlett, *University of Illinois, Dept. of Physics, Urbana, Ill.*, and F. H. Giles, Jr., *University of South Carolina, Columbia, S. C.*

By microscopic observations of a vertical copper anode during electrolysis in phosphoric acid, the dependence of electropolishing on voltage and current density has been recorded. In 50% H_3PO_4, two regions of applied voltage were found in which polishing occurred: a lower region just at and above the knee of the steady-state current-voltage curves (between 0.1 and 0.26 v with respect to 0.1*N* calomel) and an upper region which extended from a steady-state voltage of approximately 0.8 v with respect to 0.1 calomel up into the region of oxygen evolution.

The sensitivity of the polishing surface to electrical and mechanical changes in each of these regions of polishing has been observed, as well as the variation with acid concentration of the extent of the polishing regions themselves. These data are discussed in terms of our knowledge of the Cu-H_3PO_4 anodic system, and the signifiance to the theory of the mechanism of electropolishing is considered.

Application of Electropolishing and Chemical Polishing to Heat Sink Material

P. T. Woodberry, *Avco, RAD, 201 Lowell St., Wilmington, Mass.*

Electropolishing and chemical polishing techniques were used to prevent the occurrence of defective zones

of copper-copper interfaces in the electrodeposition of thick copper. Electropolishing could be substituted for grinding and machining of nodules prior to subsequent layer deposition. Copper was polished, electropolished, or chemically polished before deposition of thick nickel; the effect of surface preparation and type of copper on the elevated temperature properties of this system are discussed.

Electropolishing in Cyanide Electrolytes

F. Sullivan and E. H. Newton, *Arthur D. Little, Inc., Cambridge, Mass.*

The theory and practice of electropolishing silver, sterling silver, gold alloys, and brass in cyanide electrolytes are described. Commercial electroplishing of silver plate, pilot plant experience in electropolishing sterling silver, and laboratory investigations into gold alloys and brass electropolishing are covered. Compositional and operational variables in each process are reviewed.

Some Electrode Processes on Copper Anodes in Orthophosphoric Acid Solution

K. F. Lorking, *Aeronautical Research Labs., Box 4331, G. P. O., Melbourne, Australia.*

Theories on the structure of the electrical double layer formed at polarizable anode surfaces and on electrode processes at reacting anodes are used to indicate the processes to be expected on copper anodes in orthophosphoric acid solutions. A description and discussion are given of experiments showing the influence of increasing anode potential on surface finish and film formation on copper anodes in orthophosphoric acid. Theories of the mechanism of electropolishing are discussed and it is shown that modifications of these theories are indicated by experiemental observations.

Relationship between Brightness and Structure in Electroplated Nickel

Rolf Weil and R. A. Paquin, *Dept. of Metallurgy, Stevens Institute of Technology, Hoboken, N. J.*

The as-plated surface microstructure of deposits of varying brightnesses was examined by electron microscopy. A linear relationship was found between the fraction of the surface area with roughness less than 0.15 μ and the logarithm of the quantity of light reflected. No direct relationship between the degree of preferred orientation and brightness was found, but the fiber axis is related to the structural type and the addition agents in the bath.

Measurement of Elastic Modulus and Internal Friction in Electrodeposits

H. J. Read and A. H. Graham, *Dept. of Metallurgy, The Pennsylvania State University, University Park, Pa.*

Experimental techniques and calculations for the determination of elastic modulus and internal friction from sonic measurements on thin-walled tubes prepared by electrodeposition are described. A method of making the tubes with the necessary precision is presented. Data on the effects of some plating variables are given, but special attention is devoted to relationships between the structures of the deposits and the elastic properties under study.

Zinc Plating of Carbonitrided Steel*

H. T. Francis and L. R. Kohan, *Armour Research Foundation, 10 West 35th St., Chicago 16, Ill.*

A fundamental study was made of the difficulty sometimes encountered in barrel zinc plating of carbonitrided steel parts. A very successful laboratory technique was devised for simulation of barrel plating in a still plating bath. Results suggest that the difficulty in achieving zinc coverage on the hardened parts is caused by a "plate and dissolve" mechanism.

*This work was supported by the Shakeproof Division of Illinois Tool Works.

Adhesion of Thick Chromium Deposits as Affected by Surface Preparation

H. Chessin and C. L. Alderuccio, *Van der Horst Corp. of America, Olean, N. Y.*

Photomicrographs show that honing, a mild and slow-speed operation as compared to either grinding or machining, may cause extensive damage to the surface of cast iron. Chromium electrodeposited on these damaged surfaces will exhibit poor adhesion not because the adhesion of the chromium to the iron is poor but because the surface layer of iron is weak.

Deposition of New Chromium-Iron Alloy Plate of Banded Structure

L. D. McGraw, J. A. Gurklis, and C. L. Faust, *Electrochemical Engineering Div., Battelle Memorial Institute, Columbus 1, Ohio,* and J. E. Bride, *Diamond Alkali Co., Cleveland, Ohio.*

A new bath composition and its operating conditions are described for electrodeposition of hard, bright, chromium-iron alloy plate having banded microstructure. A precipitation mechanism is proposed to account for the microstructure of the plate.

Electrodeposition of Chromium from Low Valence Compounds, I. Investigation of Bath Types and Operating Conditions

G. R. Sherwood, M. R. Holmes, and Finn Bergishagen, *Dept. of Chemistry, Wayne State University, Detroit 2, Mich.*

Excellent quality chromium metal can be deposited at comparatively good efficiency from baths in which the chromium is chiefly trivalent. Presence of divalent chromium in such baths does not seem essential but does seem beneficial. A mixed bath, containing chiefly chloride-formate-fluoborate, is recommended rather than a bath containing one salt only.

Electrodeposition of Amorphous Selenium

A. K. Graham, H. L. Pinkerton, and H. J. Boyd, *Graham, Savage and Associates, Inc., Jenkintown, Pa.*

Amorphous selenium coatings have been electroplated in thicknesses up to (and thicker coatings can be prepared) 30 μ (1.2 mils) on bright nickel cath-

(*Continued on page* 79)

Science for the Coatings Technologist

Part XIV. Additives: Surfactants

By E. S. Beck

This is the first part of a two installment article. The second, and concluding part, will follow in the next issue of *Metal Finishing*.—Ed.

THE surfactants are at once one of the newest classes of materials and one of the oldest to be used in paint technology. They are old in the sense that a few wetting or emulsifying agents have been used almost from the beginning of paint manufacture. These agents, such as linseed oil, resin, and the like, were employed principally for other purposes; and their surfactant properties were almost incidental. Gradually, a whole art and science has arisen around the surfactants and surface chemistry.

Only a small portion of this immense field is concerned with protective coatings. Until the advent of latex or emulsion coatings, surfactants played a relatively minor part in paint formulation. In emulsion coatings, surfactants are absolutely indispensible. This alone makes them important in paint technology, because of the present great importance of emulsion coatings. This widespread use in one application has encouraged the use of surfactants in many other areas of paint formulating.

Surfactants are substances which affect the surface tension of other materials. That is a very general definition, and actually tells us rather little. To make it more specific, and only a little less accurate, we may say that surfactants almost always work to lower the surface tension of materials. We can also say with accuracy that at least two materials are generally involved in surface phenomena; and that at least one is a liquid in the majority of cases.

We speak of surface tension in the case of a liquid which is in contact with air; or which has, in other words, an interface with air. When two substances, such as two liquids, or a solid and a liquid, are in contact with each other, we speak of the interfacial tension rather than the surface tension. The need for both terms is given by the fact that a liquid in contact with air is little influenced by that fact, hence its surface tension is essentially a property specific to the liquid alone. Two liquids in contact with each other can greatly affect each other, so that the interfacial tension as measured applies only to those two liquids when in contact with each other.

Surface tension is the cohering force in liquids. It is the result of the intermolecular attraction of the molecules of the liquid upon each other. It is this force which causes liquids to assume the drop form when suspended or falling in air. When the liquid is contained in an open vessel, the pull is all toward the center of the liquid, as the gravitational effect of the air is too small to be considered. Hence, the pull upon the surface of the liquid is unequal, with a much greater force pulling toward the center than in any other direction. As a result, the surface is rather strongly pulled in, forming in effect what may be thought of as a skin. It is on this "skin" that needles and razor blades may be floated, in the case of water. Care must be taken that the items are gently applied, without breaking the "skin." The addition of a small amount of surfactant makes this impossible.

The interfacial tension between two liquids or between a solid and a liquid is an indication of the ease with which they can be mixed together. When this tension is reduced to a low enough level, two hitherto immiscible materials, such as oil and water can be brought together. This is the principle behind the so-called solubilized oils.

The surface tension of water is 72 dynes per centimeter. Most surface-active materials will reduce this appreciably, the effective ones bringing the value down to around 30 dynes at a concentration as low as one tenth of one per cent. In order for a surfactant to function as a wetting agent it must reduce the surface tension of the liquid to which it is added. This reduction should be rapid. While all good wetting agents reduce surface tension markedly, it is not always true that substances which reduce surface tension are ipso facto good wetting agents. This has led to the development of other types of tests aimed at evaluating wetting power more directly, especially for use where textiles are involved.

Surfactants, because of their action on the surface or interfacial tension, are variously used as emulsifying agents, detergents, spreading or leveling agents, foaming agents (and anti-foaming agents) wetting agents, and in paint formulating, as grinding aids, anti-flooding and anti-silking agents, etc. While all of these functions can be attributed to the action of surfactants on the interfacial tension of materials, it does not follow that any one material will be able to do everything. Generally, each substance is valuable in the main for doing one or two things especially well. Furthermore, there are often dozens of agents which have done a particular thing well in other circumstances. The problem is to select the best material for a given individual situation with the minimum of research. This is the part of the field which is still very much an art.

Surfactants are most frequently classified according to their general composition. All surfactants have one thing in common in their composition. That is the presence of a polar or hydrophilic portion and a non-

polar or hydrophobic portion in the same molecule. One of the things which define the characteristics of a surfactant is the relation between the polar and non-polar portions of the molecule. The non-polar part is an organic chain or ring of some sort, consisting essentially of carbon and hydrogen. The polar portion is high in organic atoms, such as oxygen or nitrogen, and is often organized into sulfonic acid, carboxylic acid, amine, alcohol and other similar configurations.

The relative importance of each part of the molecule is governed by the activity and the number of groups present. The solubility in water increases as the polar portion is increased in importance; while the solubility in non-polar solvents, such as xylol, goes up as the non-polar portion of the molecule is increased. The balance between these two characteristics will, in great measure, determine the value and the properties of the surfactant.

The most common classification of surfactants by chemical type is a three-fold one: anionic, cationic and non-ionic. The first two constitute a single group (ionic type) in that members of both ionize when in solution into a negative and a positive portion. The negative portions are charged negatively, hence migrate toward the anode in an electrical cell. The positive portion is attracted to the cathode. If the surface-acting quality of the material resides in the cathode-seeking portion of the molecule, the material is classed as cationic. The reverse case is known as anionic. Where the molecule does not ionize, the agent is known as non-ionic.

Anionic Types

The oldest, and most widely known surfactants are in this class. Soap (sodium or potassium oleate or stearate) is the typical example. The anion (oleate or stearate ion) is possessed of surface-acting value. This group is very large, and includes, in addition to the soaps (of which there are a very large number), the sulfonic acids, sulfates, sulfamates, and a number of other materials of similar type.

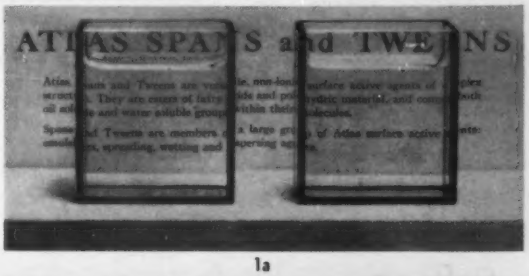
As these materials are almost invariably used as salts of the alkali metals or ammonium, they show one drawback which must be guarded against. They are subject to precipitation in the presence of divalent or heavy metal ions, such as calcium, iron, magnesium, etc. In such a situation, a non-ionic material must be used, or the offending metal ions removed. Anionic types also do not work well in acid conditions.

The anionics are the work-horses of the synthetic detergent industry. Since the first to be used (sulfonated oils) they have dominated the field in almost every aspect. Most of the detergents used in industry and by the consumer in the form of shampoos, soap replacements, etc. are anionic. The first synthetic detergents introduced for consumer use were aryl alkyl sulfonates.

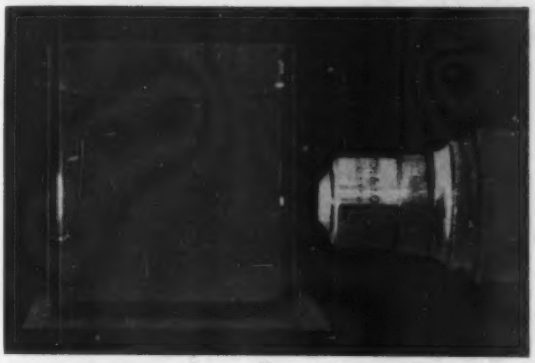
These materials have also found wide use in the textile industry, where wetting out of the fabric is essential before dyeing. Even during World War II, the growth of synthetic detergents proceeded at a steady pace. This is because detergents actually conserved fats and oils. On average, a pound of fat makes about 1¼ lbs of soap. The same pound of fat will make 3 or 4 lbs. of commercial detergent (35% active) of roughly equivalent activity.

Anionics in general show excellent lathering and foaming tendencies. This is not an advantage in the paint industry. Foaming in latex emulsions is very undesirable, and manufacturers have gone to great lengths to eliminate it or at least reduce it. Anionics are not the only agents used for emulsification purposes, fortunately, or the foaming problems would be even greater. In fact, anionics are not especially good for emulsification, in comparison with non-ionics.

Anionics are very useful in increasing the wettability of pigments for incorporation in latex paints. They also are used to an extent in preparation of flushed pigments. Despite their generally hydrophilic



1a



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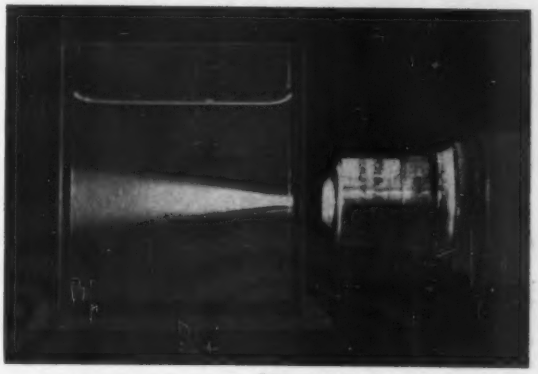


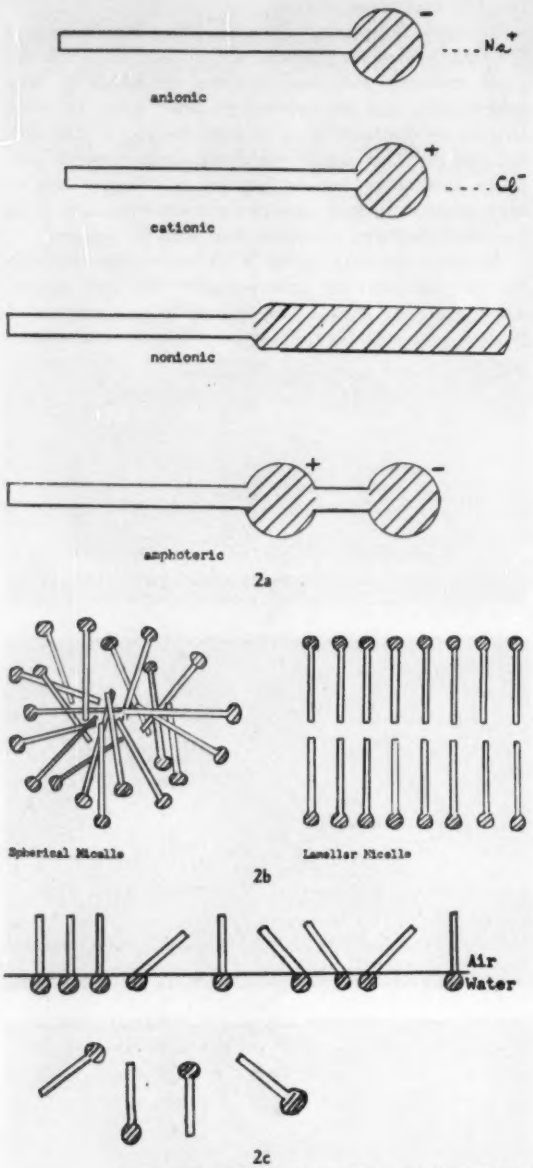
1c

(Courtesy Atlas Powder Company)

Fig. 1. Demonstration of the Tyndall Effect.

True solutions are uniform in composition and contain the sclute or dissolved material in molecular or ionic form. These particles are so small they do not interfere with the passage of a ray of light. Colloida! dispersions can seem just as clear as true solutions. The two vessels shown in Figure 1a illustrate a true solution (left) and a colloidal suspension (right).

In a true solution (fig. 1b) the patch of light from a point source is invisible as it passes through the solution. With a colloidal suspension, the cone of light is very obvious. Fig. 1c shows the colloidal dispersion (in this case a surfactant) always has the dispersed phase in clumps or micelles.



(Courtesy Official Digest of Federation of Paint and Varnish Production Clubs.)

Fig. 2. Schematic Representation of Surfactant Properties.

Figure 2a shows schematically the four types of surfactants. The active portion of the molecule is shown shaded and enlarged.

In figure 2b we see schematic representations of two types of surfactant micelles. These clumps (there are other types also) are the form in which the surfactant exists when in suspension.

Figure 2c shows the orientation of a hydrophilic surfactant at the air-water interface. The long, hydrophobic portion of the molecule, being repelled by the water, projects into the air. The hydrophilic portion remains in the water. The particular surfactant in this case is a soap. It is this ability to concentrate at interfaces which gives surfactants their unique value.

character, they can often be used to advantage in the dispersion of pigments in organic vehicles.

Cationic Types

These are the surfactants in which the activity resides in the positively charged ion. Most of these are derivatives of nitrogen, especially in the form of quaternary ammonium compounds. Other nitrogen compounds are the amine bases, which are actually quite similar chemically to the quaternary ammonium compounds. A few phosphorus and sulfur compounds are occasionally encountered in the cationic group.

The amine bases (primary, secondary or tertiary) are generally insoluble in water. The quaternary ammonium compounds are normally water-soluble. It is a relatively simple operation to convert the amine base into the quaternary salt where this is desirable. In other respects, the properties are similar, after allowing for the solubility and reactivity differences entailed in the reaction.

Cationics are usually not good detergents, and do not compare with the anionics in detergency. They represent only a very small portion of the total production of synthetic surface active agents. This is not to say that they do not have their values in specific applications. The cationics often will work quite well in acid solutions, unlike the anionic materials. Some are sensitive to alkalinity however, and generally cannot be used at high pH's.

Many of the cationic quaternary ammonium compounds are extremely good germicides and disinfectants. They find their widest application in medical and sanitary uses. They also have certain textile applications where cationic properties are needed.

In general, cationic and anionic surfactants are not compatible with each other. If they are mixed, there is usually a waxy precipitate, and the end of further surface action. This means that care must be exercised in blending emulsions or compositions to avoid such incompatibilities. An interesting corollary of this incompatibility between anionic and cationic agents is that this can be put to valuable use. In cases where the action of an anionic agent is wanted only for a certain time, it can be inactivated by the addition of the appropriate amount of cationic agent. The reverse also holds.

The first, and simplest of the cationic surfactants were the amines of long-chain fatty acids. Many of the materials in use today are directly derived from these relatively simple compounds. They are commonly used in the form of amine salts, such as the halides, sulfates, etc. The free amine form would be suitable for use where water solubility was not required.

Complex polyamines, such as tetramethylene pentamine, are not generally considered as ionic, although they may act mildly cationic in solution. These will be usually classed as non-ionic materials.

Non-Ionic Types

These are the complex products, usually ethers, esters or amides, which do not ionize in solution. While not perhaps quite so rapid or efficient in wetting as the anionics, the non-ionics are frequently very good wetting agents. They are not generally considered detergents, but many individual materials in this class are quite valuable detergents nonetheless. It is as emulsifying agents that the nonionics are most distinguished.

There are a number of reasons why these surfactants are so highly regarded as emulsifying agents. To be-

gin with, an agent which produces stable emulsions readily should be soluble in both the oil and the water fractions of the emulsion. If it is too soluble in the water portion, or too soluble in the oil portion, at the expense of the other fraction, the emulsifying characteristics will be unsatisfactory. Many non-ionics are soluble in both types of liquids equally.

Once the emulsion has been prepared, it is desirable that it be compatible with as many other materials as possible. Here is another advantage of the non-ionic type. In general, they have good compatibility, with each other and with anionic and cationic materials. This is not universal, of course, and each combination should be tried out in the laboratory before using.

A further advantage of non-ionics is that they are not affected by hardness in the water, or heavy metal ions from other sources. Emulsion paints prepared only with non-ionic surfactants can contain calcium, lead, barium, magnesium, and other metals in the pigmentation. These would be inadmissible in the coatings containing anionics.

Non-ionics in the main, are not affected severely by the presence of acid or alkaline conditions. Many of them can be used even in extreme acid and alkali solutions. This gives non-ionics a flexibility of application which anionics cannot approach.

The price of the average non-ionic is considerably higher than that of the anionic, however. This causes formulators to consider anionics first, and to use non-ionics only where circumstances make them essential. Many formulations contain blends of anionics and non-ionics to obtain at least some of the advantages of non-ionics at a reasonable cost.

The non-ionics are, as a class, weak in lathering properties. This may be a drawback in some fields, but in coatings work it is a positive advantage. There is still a certain tendency to foam, but it is much less than with the anionics.

Non-ionics sometimes work synergistically with the anionics to the marked improvement of performance. In the case of alkyl aryl sulfonates, the addition of 20% of selected non-ionic can increase the detergency (for wool or cotton) by 100%, or even more. Addition of non-ionics to anionics also increases the efficiency of the anionic in hard water by making it more soluble.

Amphoteric Types

A subdivision of the non-ionic surfactants is known as the amphoteric type. These materials are sometimes known as ampholytic surfactants. The molecule of the amphoteric compound contains two charged portions, one anionic and one cationic. Actual ionization into separate portions does not normally occur. However, amphoterics frequently show anionic characteristics in alkaline solution, and cationic ones in acid solution.

Amphoteric surfactants are not a new category of product but, until recently, they have been very little used. Certain valuable specialized applications have been recently worked out, and a number of amphoterics now are enjoying a certain degree of commercial use. These materials are usually derivatives of amines and sulfate or carboxylic acids. The nitrogen of the amine, in the quadrivalent ionic form is the center of the cationic charge, while the carboxyl or sulfate group is negatively charged, hence the anion.

The value of amphoterics seems to lie in the fact that they can be used where cationics are indicated, without some of the disadvantages of cationic surfactants. They are valuable in textile work because they orient to the surface, provide water resistance and some improvement in feel. Like the cationics, the amphoterics show germicidal properties.

Their chief advantage, however, resides in the fact that, unlike cationics, they are compatible with anionic agents.

ELECTROCHEMICAL SOCIETY

(*Continued from page* 75)

odes. Data are given for studies leading to the selection of the optimum bath and operating conditions for the formation of reproducible, uniform, and adherent deposits. It is shown that the plating baths employed and the amorphous deposits obtained are extremely sensitive to a variety of conditions, thus emphasizing the need for further study of the electrodeposition of selenium in the amorphous form.

Studies of Hydrogen Embrittlement by the Use of Deuterium

G. B. Wood, *National Bureau of Standards, Washington 25, D.C.*

Fundamental studies dealing with the passage of the hydrogen isotopes through SAE 4130 steel are discussed. The rate of passage of hydrogen through steel, the amount of hydrogen causing embrittlement, and the resulting severity of embrittlement are correlated. The use of deuterium as the embrittling isotope permits a differentiation between hydrogen electrolytically introduced into steel and that introduced due to metallurgical procedures. Hydrogen embrittlement of steel accompanying cadmium and chromium plating and alkaline and acid electrolytic treatment in the presence and absence of poisons are discussed.

The Source of the Nitrogen Impurity in Electrodeposited Chromium

N. Ryan and E. J. Lumley, *Aeronautical Research Labs., Dept. of Supply, Box No. 4331, G. P. O., Melbourne, C. 1, Vic., Australia.*

High-purity chromium deposited from chromic acid electrolytes containing either sulfate or fluoride catalysts invariably contains small amounts of nitrogen as an undesirable impurity. The amount of this nitrogen impurity is shown to be increased by increased nitrate ion concentration in the electrolyte but not affected by dissolved atmospheric nitrogen or ammonium compounds. It is demonstrated that the nitrate impurity is decomposed at the cathode by reduction with hydrogen to form ammonia as the major product. Some of the atomic nitrogen which is possibly formed at a stage during this reduction is probably adsorbed continuously into the electrodeposited metal.

Science for Electroplaters

52. Copper Plating - IV

By L. Serota

Copper Fluoborate

THE use of fluoborates for plating solutions is generally associated with the growing need of heavier deposits which, in turn, require higher plating rates. Copper fluoborate $Cu(BF_4)_2$ solutions, for example, in the presence of free fluoboric acid, HBF_4, permit exceptionally high plating speeds. As with the acid copper sulfate bath, the divalent copper (cupric, Cu^{++}) salts in the fluoborate bath are highly ionized and, with the resulting low anode and cathode polarization, the voltage necessary to deposit copper from these baths is less than that required to deposit copper from alkaline baths.

The fluoborate bath presents many advantages over other copper baths. The greater solubility of copper fluoborate, equivalent to about 120 g./l. of copper, compared to a solubility for copper sulfate, in the presence of sulfuric acid, of about 75 g./l. of copper, permits the use of higher current densities. Higher limiting current densities are also possible for equal copper concentrations, a factor which W. Blum associates with, possibly, the ability of fluoborates to prevent the precipitation of basic copper compounds in the cathode film at a higher pH than that which would occur in the copper sulfate bath. The greater solubility also makes possible higher concentration baths without crystallization of the salt occurring on tanks or equipment. Deposits are smooth and excellent in appearance; with controlled conditions, deposits may be soft and easily buffed to a high duster, or the deposit may be hard and possess high strength. Anode and cathode efficiencies are approximately 100 per cent; anode current density is not critical because of the high solubility of the copper fluoborate bath.

Fluoboric acid is produced by the reaction between hydrofluoric acid and boric acid, $4HF + H_3BO_3 \rightarrow HBF_4 + 3H_2O$. Usually, an excess (about 10 per cent) of boric acid is added to prevent decomposition. The copper salt, copper fluoborate, may be produced by the addition of copper (basic) carbonate to the acid: $2CuCO_3 \cdot Cu(OH)_2 + 6HBF_4 \rightarrow 3Cu(BF_4)_2 + 4H_2O + 2CO_2$. Since the fluoborate bath is acid, deposition by immersion will occur with steel (ferrous metals) unless a cyanide copper strike is applied previously.

TABLE I
Standard Plating Solutions

	Regular	High concentration
Copper fluoborate, $Cu(BF_4)_2$, g/l.	224	448
oz/gal.	30	60
Copper, Cu, g/l.	60	120
oz/gal.	8	16
Gravity at 80° F, °Bé.	21–22	37.5–39
pH, colorimetric	1.2–1.7	≅ 0.6
Temperature, °F.	80–170	80–170

BATH COMPOSITION:

C. Struyk and A. E. Carlson made an extensive study of the effect of various factors, such as pH, free fluoboric acid, boric acid, metal concentration and temperature on limiting current density and resistivity. Limiting current density served as a basis for determining optimum operating conditions and was considered to be the current density at which burning showed at the edges of a panel. The effect of current density on anode and cathode voltages and anode sludge formation was also studied.

The standard copper fluoborate plating solutions recommended by the authors for regular and high concentration are listed in Table 1. Copper fluoborate is available as a 45 per cent, by weight, solution. To prepare the bath this concentrate need merely be diluted with water, low in chlorides. Colorimetric paper may be used to check the pH of the solution. The glass electrode cannot be used for determining pH values because glass is affected by the fluoborate ion. Fluoboric acid is used to lower the pH and copper carbonate to raise the pH.

Tanks should be lined with rubber or a suitable plastic. Lead linings cannot be used, since lead is readily dissolved and will cause brittle deposits.

OPERATING CONDITIONS:

Experimental determinations were made with steel plates, flashed first with copper, from a Rochelle cyanide copper bath. A copper anode was used. Plating time for different current densities was estimated to produce a thickness of 0.001 inch.

Results obtained with varying amounts of free fluorboric acid on limiting current density (and resistivity) in a bath containing 60 g./l. copper and 16.2 g./l. boric acid indicate that concentrations of fluoboric acid up to 8 g./l. will have little effect upon the limiting current density. Thus,

TABLE II
Effect of pH and Free Fluoboric Acid on Limiting Current Density and Resistivity

Bath Composition—60 g/l copper metal
16.2 g/l boric acid

Fluoboric Acid g/l	pH Colorimetric	Limiting current density,* asf		Resistivity ohm/cm³	
		80° F	120° F	80° F	120° F
0	1.4	150	225	8.4	—
2†	1.2	150	250	8.4	5.9
4	1.2	150	225	8.2	—
8	1.1	150	200	8.0	—
16.2	1.1	125	200	7.9	—
32	0.4	100	175	6.5	—
44	0.3	100	200	5.8	—
60	0.3	75	175	5.1	—
64	0.3	100	150	5.0	—
92	0.2	100	150	4.2	—
156	0.1	75	75	3.2	—

*Based on 1 mil thick deposits, no agitation

†Optimum value

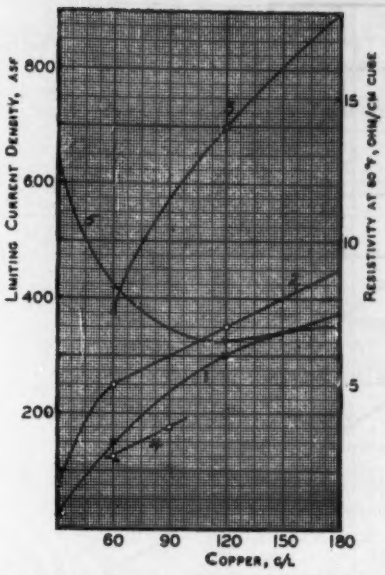


Fig. 205. Effect of copper concentration in copper fluoborate baths containing 2-4 g./l. fluoboric acid and 16 g./l. boric acid on limiting current density at 80°F. (curve 1), 120°F. (curve 2) and 170°F. (curve 3) and on resistivity at 80°F. (curve 5). Curve 4 represents the limiting current density for a copper sulfate bath at 120°F.

variations in concentrations from 2 g./l. to 8 g./l. of fluoboric acid gave the same limiting curent densities, namely 150 amp./ft.^{2} at 80°F. and 225 at 120°F. An appreciable lowering of limiting current density resulted, however, at higher concentrations. This is indicated in Table 2. An increase in conductivity (or decrease in resistivity), the table shows, results with increasing concentrations of fluorboric acid. The greater limiting curent densities possible at the higher temperature (120°F.) are significant and indicate the operational advantage at the higher temperatures, considering the stability of the solution. A concentration of 15 g./l. (2 oz./gal.) boric acid was found to be sufficient for satisfactory operation, and that amount is usually included in the fluoborate concentrate.

METAL CONCENTRATION:

Changes in metal concentration with boric acid and fluoboric acid relatively constant, have a decided effect upon the limiting current density. It was found, for example, that with a copper concentration of 30 g./l. (4 oz./gal.), though a satisfactory deposit is possible, the limiting current density is only 80 amp./ft.^{2} at 80°F. and 75 at 120°F., whereas, doubling the copper concentration (60 g./l. or 8 oz./gal.) resulted in an increase in the limiting current density from 150 at 80°F. to 250 amp./ft.^{2} at 120°F. and as high as 375 at 175°F. When the copper concentration in the fluoborate bath was increased to 120 g./l. (16 oz./gal.) the limiting current density showed a continued rise extending from 300 at 80°F. to 350 amp./ft.^{2} at 120°F. and, when the fluoboric acid was increased to 32 g./l. (4.3 oz./gal.), the limiting current density was 375 for 120°F. and 700 amp./ft.^{2} at 170°F. A metal content of 180 g./l. (16 oz./gal.) gave a limited current density of 350 amp./ft.^{2} at 80°F. and 450 at 120°F. The graph for this data, Fig. 205, shows significantly that resistivity decreases up to a metal concentration of 120 g./l., but will show an increase as the metal concentration rises to 180 g./l. (Curve 5).

A comparative study of the limiting current densities of copper fluoborate and copper sulphate baths for the same concentrations of copper shows clearly the higher limiting current densities possible with the fluoborate bath. For a concentration of 60 g./l. copper, a limiting current density of 350 amp./ft.^{2} at 120°F. was obtained for the copper fluoborate bath against 125 amp./ft.^{2} for the copper sulfate bath; and again for a 90 g./l. concentration of copper, the fluoborate bath showed a greater limiting current density of 300 amp./ft.^{2} at 120°F. against 175 for the sulfate bath. These values plotted as Curve 4 in Figure 205 show very clearly that the limit of copper concentration for the copper sulfate bath, at higher temperatures, is about 90 g./l. or 300 g./l. of $CuSO_45H_2O$, due to crystallization of copper sulfate with temperature decrease. This is due to the limited solubility of this salt, a difficulty not inherent in the copper fluoborate bath.

The anodes, it was found, unlike those used in the acid sulfate bath, are remarkably free from polarization, so that operation at high anode current densities is possible. Another observation made was that the amount of reddish brown anode sludge formed is much less in quantity than that formed in copper sulfate baths. For thick smooth deposits, anode bags are suggested. Further, the high anode efficiency, under all conditions, obviates addition of metal salts to the bath to maintain the metal content.

ANALYSIS:

The metal concentration may be determined by the same procedures used in the acid copper sulfate bath, namely by electrolytic deposition, or volumetrically by the reduction of the cupric ion by potassium iodide, followed by titration with standard sodium thiosulfate.

Free fluoboric acid is determined volumetrically. A 5 ml. sample of the bath is diluted with distilled water to 50 ml. and titrated, with constant stirring, with 0.25N NaOH. Titration is continued until the first permanent turbidity results. This is considered the end-point. Comparison of the titrated sample with a similarly diluted sample can serve as a guide for determining turbidity. W. H. Safranek and J. H. Winkler suggest a blank run on a copper fluoborate solution which does not contain free fluoboric acid. For the metal (or salt) concentration used in the regular bath (60 g./l.), about 7 ml. of 0.25N NaOH will be required for the blank run; and, for

TABLE III

Bath Composition and Operating Characteristics of Copper Alkanesulfonate Baths

Composition g/l	Bath No. 25-10	Bath No. 50-10	Bath No. 100-10
Basic cupric carbonate (55.5% Cu), g/l.	45.1	90.1	180.2
Copper (as metal), g/l.	25	50	100
Free alkanesulfonic acid, g/l.	5-10	5-10	5-10
Operating Characteristics*			
Limiting current density† at 120° F, asf.	150	350	700
Practical current density range at 120° F, asf.	20-100	100-250	250-600
Limiting current density† at 150° F, asf.	200	400	1200
Practical current density range at 150° F, asf.	20-150	100-300	500-800
Cell voltage at 150° F.	0.5-4.0	2.5-6.5	8.5-12.0
Ratio anode to cathode area	1:1	2:1	4:1

*With work rod movement = 2-inch stroke, 32 cycles/min.
†Limiting current density is defined as the maximum asf which gives satisfactory 0.001 inch plate.

the high concentration bath (120 g./l.), 8.4 ml. of 0.25N NaOH will be required. These values, therefore, must be subtracted from the calculations in an analysis.

Alkanesulfonic Acid Bath

C. L. Faust and associates described the development of an alkanesulfonic (strong) acid bath, which was found to be favorable for depositing a semi-bright copper plate at a current density range of 60-1000 amp./ft.^{2} without the use of addition agents. The deposited metal was easily color buffed and found to be smoother than the deposits obtained from simple inorganic baths.

The alkanesulfonic acids are monobasic and form metal salts that are soluble in water, highly ionized, and quite stable. The general formula may be represented as RSO_3H, with R referring to the methyl, CH_3; ethyl, C_2H_5; propyl, C_3H_7; or butyl, C_4H_9, groups. For the copper plating solutions studied, a mixture of methane, ethane, and propane sulfonic acids was used.

The copper alkanesulfonate was prepared by adding chemically pure basic copper carbonate, $2CuCO_3 \cdot Cu(OH)_2$, slowly with stirring, to the diluted acid concentration. When dissolution was complete, the solution was brought up to the required volume. The solution was purified by adding filter aid, mixing and filtering, followed by carbon treatment and dummying.

The composition and operating characteristics for three baths are shown in Table 3.

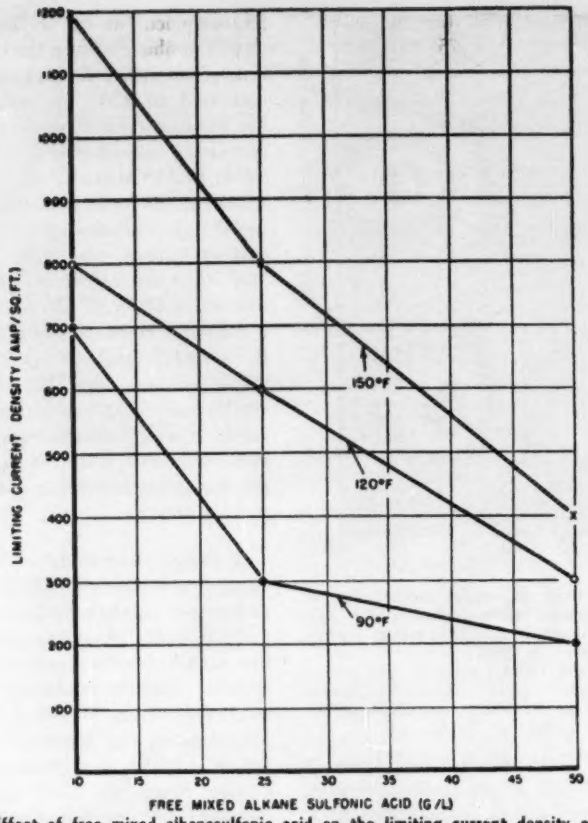


Fig. 207. Effect of free mixed alkanesulfonic acid on the limiting current density of a copper alkanesulfonate bath containing 100 g./l. copper.

LIMITING CURRENT DENSITIES:

A smooth pink deposit was obtained on a soft brass plate at a current density of 60 amp./ft.^{2}, 120°F. or 150°F., for the low concentration 25 g./l. bath, with finer grain deposits resulting at current densities above 100 amp./ft.^{2} At the lower current density, the plates showed a hard crystal structure, requiring a hard wheel at high speed for buffing, but deposits with the higher current density were buffed easily to show a smooth surface. A significant operational advantage for this specific bath is the permissible wide range of current density, so that irregular-shaped objects may be plated with a good margin of safety.

Deposits from the bath containing 50 g./l. copper, operating at a current density of 150 amp./ft.^{2}, were smooth, fine-grained and easily buffed; and, the high concentration bath (100 g./l. Cu), under careful control of temperature and current, gave a lustrous copper plate for current density ranges between 60 and 500 amp./ft.^{2} (90°F.). The suggested range is 150-200 at 90-120°F., with ductility specified as the controlling factor. The lustrous plates are readily buffed and give a good color when followed by bright nickel, thereby eliminating the buffing operation. Figs. 206 and 207 show graphically the effect of the free mixed alkanesulfonic acids on the limiting current densities, for the three baths containing copper alkanesulfonate expressed in concentrations 25, 50 and 100 g./l. of copper, respectively. An increase in

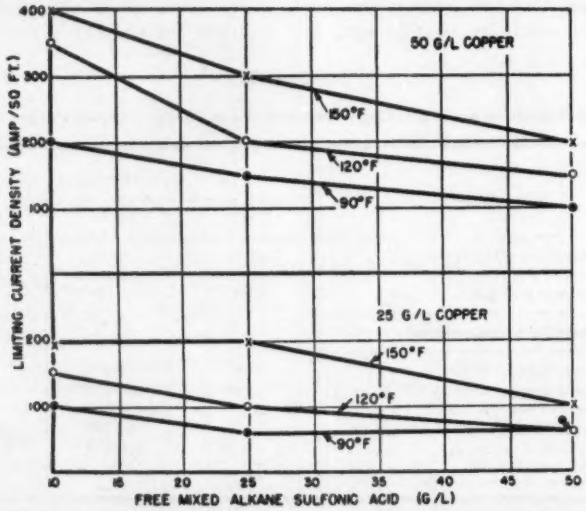


Fig. 206. Effect of free mixed alkanesulfonic acid on the limiting current density of copper alkanesulfonate baths containing 25 and 50 g./l. copper.

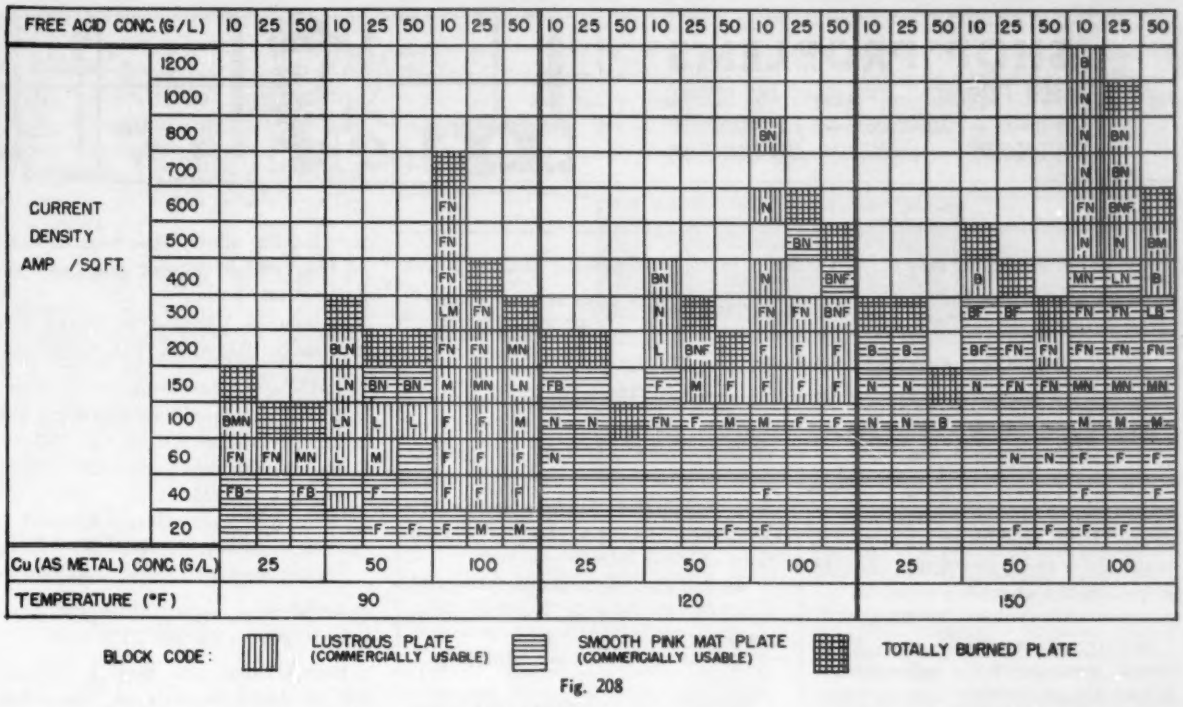


Fig. 208

free acid above 10 g./l., the graphs show, lowers the limiting current density. This effect (drop) is pronounced in the graph for the 100 g./l. solution of copper.

Metal Concentration:

An increase in copper concentration will show a corresponding increase in limiting current density. With an increase in metal content, an interesting phenomenon occurs in the deposited metal. When a plate is bent, an effect described as a "cry" results, which is compared to the effect produced when block tin is strained. This is associated with crystal structure. So called crying plates 0.001" thick, in some cases, may be bent as much as 180° without showing any cracks; at other times cracks result, indicating, according to the authors, that this condition is not the same as that associated with ductility. Ductility is determined by the effect of bending a plate 180°. The absence of cracks for a set of plates so treated indicates a coating of high ductility. Fig. 208 is a comprehensive chart in which all factors relating to the characteristics of copper deposits from this alkanesulfonate bath are represented. It is interesting to note that the "cry" emitted by panels plated at 90°F. is greater than that produced at the higher temperature of 150°.

Throwing Power:

To study the throwing power of copper alkanesulfonate bath, a bent cathode was employed. Both the 25 g./l. and 50 g./l. copper bath compositions were used, and comparative tests were made with two copper fluoborate solutions containing, respectively, 60 and 120 g./l. copper. The pH of the 60 g./l. bath was adjusted to 1.2 and that of the 120 g./l. bath to 0.5. The anode was placed in a position so that it was opposite the recessed part of the cathode, and a distance of 1½ inches from the cathode, measured at the solution level. Current density (60 amp./ft.^{2} for the low concentration bath and 200 for the high concentration bath) calculations were based upon the surface area facing the anode, and the solution was agitated, using a 2 inch recipcrocating movement, 32 cycles per minute.

Plating operation was conducted at 150°F. and continued for a sufficient time to give a plate thickness of 0.010 inch. The copper deposits on the bent cathode of brass basis metal were then given a protective nickel plate (0.002-0.003") using a Watt's bath.

Results revealed, the authors noted, the following facts: throwing power for the copper alkanesulfonate bath is about the same as that of the fluoborate bath; coarser grains develop from the sulfonate bath after deposits are more than 0.003-0.005"; of especial attention was the absence of columnar structure which is readily discernible in the fluoborate bath with the grains in a perpendicular order to the basis metal. The random distributions of the grain structure in the sulfonate bath is associated with the "cry" when the plate is bent.

The following conclusions based upon the experimental runs were presented: deposits that are fine grained, giving smooth plates of good color and ductility, are possible without addition agents for thicknesses up to 0.005"; coarse grains with treeing around the edges result for greater plate thicknesses; the crystal structure of the deposit does not follow that of the basis metal, thereby serving to shield surface defects; wide anode current density ranges are possible; the permissible high cathode current density range with low agitation rate permits high speed operation; low metal-acid concentration is possible compared to the fluoborate bath for attainable current densities; throwing power compares with and, in some respects, is better than that of other acid baths; the fact that operating voltages are higher and the existence of a faint odor requiring ventilation would indicate possible disadvantages. The overall effects suggest, however, that the copper alkanesulfonate bath is an acid bath possessing sufficiently favorable aspects to justify commercial application.

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Titanium Baths

Question: Please advise if a plating process exists for the deposition of titanium. If no established process is in existence, is there any active research project on the above?

W. V. G.

Answer: A few years ago, A. E. Creech investigated the subject of titanium deposition from aqueous baths, and was able to obtain only trace deposits from a tartrate bath. There is no practical method available. A copy of this investigation can be obtained from Armed Services Tech. Information Bureau, Document Service Center, Dayton 2, Ohio.

Titanium has been deposited from a number of fused baths, which a search of the literature will disclose, in case you are interested in this method.

Plating on Uranium

Question: We are interested in plating on uranium and would appreciate it if you would tell us where information on this subject may be found.

W. B. H.

Answer: The following patents have been granted, and assigned to the Government, on the subject of plating on uranium:

2,835,630 (May 20, 1958)
R. Huddle & O. Flint
2,836,548 (May 27, 1958)
A. G. Gray & B. W. Schweikher
2,849,348 (Aug. 26, 1958)
A. G. Gray
2,872,389 (Feb. 3, 1959)
C. J. Slunder
2,884,364 (Apr. 28, 1959)
E. W. Rebol & R. F. Wehrmann

Anodizing Aluminum Strip

Question: We want to put an installation in our plant for the anodizing of aluminum mouldings for table tops. Our needs are about 200 1-3/8" x 18' mouldings a day. The question is this: What size tank do we need? Specifications of generator or rectifier.

We can also use brass plated mouldings. De we have to anodize before plating?

C. B.

Answer: An anodizing tank about 20' x 2' x 2' would be suitable. A double rack holding 5 strips on each side will fit very nicely, allowing room for cooling coils and agitation pipes. Since each strip has a surface area of slightly over 4 sq. ft., we would suggest a rectifier or generator with output of 1,000 amperes at 18-24 volts.

We would not recommend brass plating, if you install an anodizing line, since application of a brass color dye after anodizing will require only the addition of a dye tank and acetate sealer and, possibly, another rinse tank. Brass plating would require a complete installation for plating on aluminum which, in addition to being much more expensive, will require much closer control.

Nickel-Iron Baths

Question: Will you please advise if there is a solution formula for plating of an alloy known as "Mumetal," or a formula for plating a combination of 60% nickel and 40% iron to form a metal similar to "Mumetal." We have been unable to locate any information pertaining to this metal alloy.

H. R. F.

Answer: Mumetal is a magnetic alloy of iron, containing 76% nickel, 6% copper and 1.5% chromium. We know of no work on electrodeposition of this alloy. However, various alloys of iron and nickel, the so called high-permeability alloys, have been deposited from sulfate-chloride and from pyrophosphate baths.

A solution patented by Burns and Warner in 1931 (U. S. Pat. 1.837,355) consisted of:

Nickel sulfate	212	g/l
Ferrous sulfate	22	"
Nickel chloride	18	"
Ferrous chloride	2½	"
Boric acid	25	"
Sodium sulfate, crystal	180	"
Temperature	50°C.	

At 40 amp./sq. ft. the deposit contained 79% nickel and 21% iron.

Both Gardam and Wolf & McConnell produced deposits of iron-nickel alloys from solutions of nickel sulfate, ferrous sulfate, boric acid and sodium and potassium chloride, the former's deposits containing 80% iron, and the latter's 80% nickel. This would indicate that, by suitable modification of the solution, it is possible to obtain a 60-40 alloy.

Deposits ranging from 13 to 99% nickel were obtained by Sree & Rama Char (Bull. India Section, Electrochem. Soc., 7, 72. 1958), using the pyrophosphate bath.

Nickel Sulfamate Solutions

Question: Is it true that sulfamate baths for depositing nickel give deposits which are of no lower stress than those obtained from a Watts solution? According to what we have read, the former gives deposits with lower internal tensile stress, but we have also been told recently that the claims are overly optimistic.

G. B.

Answer: The sulfamate bath has been shown to produce nickel deposits with lower stresses than the Watts bath. However, with the use of stress-reducing agents, such as naphthalene trisulfonic acid, the Watts bath can also produce such deposits, according to recent studies. The determining factor, therefore, would be whether or not the presence of organics in the bath is permissible. If the application of the nickel

deposits is such as to permit plating from a bath with organics present, the Watts bath will be less expensive, although the much more rapid plating rate of the sulfamate bath may balance its higher cost. When operated without wetting agents the sulfamate bath has a tendency to pit, which is also a factor to be considered.

Antique Finish on Lead

Question: We are desirous of producing the antique finish on lead castings, similar to the patina effect. Do you have any procedure for producing this finish without the use of electric current? We do not have any plating equipment in our shop.

N. P.

Answer: A patina may be produced on lead by immersion or by brushing on the following solution:

Copper nitrate	8	oz./gal.
Ammonium chloride	4	"
Acetic acid	4	"
Chromic acid	1	"

Passivating Stainless Steel

Question: We are seeking a method for passivating stainless steel, grades 17-4 and 17-8, AMS 5643. Our present method, utilizing hot HNO_3, turns the parts black. Any information that you can supply will be appreciated.

H. H.

Answer: A standard passivating solution consists of 20% by volume nitric acid, which is operated at about 120° F., with an immersion time of about 20 minutes.

About 2 oz./gal. sodium or potassium dichromate may be added to the solution to minimize attack on 400 series stainless steels. However, blackening or etching usually indicates contamination of the solution or improper heat treatment prior to passivation.

White Finishes

Question: We are interested in two finishes, known as *Argentan* and *Birmingham Platinum*, which are used as white imitation precious metal deposits. Since we can find no formulas or references to these in the latest edition of the METAL FINISHING GUIDEBOOK-DIRECTORY, it would be appreciated if you could forward details on how to produce these finishes, or if you could put us in touch with suppliers of suitable processes or materials.

Z. C.

Answer: Our files indicate that both *Birmingham Platinum* and *White Argentan* are not finishes but solid metals. The former is a brass of the 43% copper-57% zinc alloy composition, and the latter is an alloy of 17.4% copper, 6.6% nickel, and 76% zinc, which cannot be produced by electrodeposition. A white brass deposit, similar in composition to Birmingham Platinum, can be produced from a number of proprietary baths and the addresses of suppliers are being forwarded.

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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Bright Nickel Bath

U. S. Patent 2,872,392. *Feb.* 3, 1959. *B. P. Martin, assignor to The McGean Chemical Co.*

An aqueous acid nickel electrolyte solution containing, per liter, about 0.5 to 25.0 grams of an unalkylated aryl sulfo compound selected from the group consisting of naphthalene mono-, di- and tri-sulfonic acids and saccharin as a primary brightener and about 2 to 100 milligrams of a secondary brightening agent consisting of an amino poly aryl methane from the group consisting of fuchsin, reduced fuchsin, p,p' methylene dianiline and 2.2', 4.4' tetramino 5.5' dimethyl diphenylmethane, and a quick-brightening addition agent, said quick-brightening agent being present in amount of from 0.01 to 1.0 gram per liter and being selected from the group consisting of lignin sulfonic acid and its soluble salts wherein the degree of sulfonation is at least about 5%.

Switch for Barrel Plating

U. S. Patent 2,872,544. *Feb.* 3, 1959. *A. R. Hoffman*

A heavy-current switching unit comprising in combination a pair of plates composed of high conductivity metal mounted in alignment and in spaced relation to each other end to to end, with faces coplanar, and edges aligned, and an encased contactor unit having an insulating housing with an insulating base with protruding pairs of spaced connection bolts, one pair of connection bolts secured to one of said plates and the other pair of connection bolts secured to the other of said plates for maintaining the plates rigidly in alignment and supporting the contactor unit from the plates, the contactor unit having brackets each electrically and mechanically secured to one of said pairs of connection bolts and having fixed contacts on said bracket, and a solenoid actuated movable contact mounted within said insulated housing in operative relation to the fixed contacts, movable in a direction parallel to the faces of said plates but perpendicular to the edges thereof.

Paint Can Attachment

U. S. Patent 2,873,052. *Feb.* 10, 1959. *W. A. Atherton*

A paint can attachment comprising a tubular member having an upper and lower end portion, said tubular member having a resilient annular flange at the lower end portion thereof extending outwardly therefrom.

Rust Inhibiting Composition

U. S. Patent 2,873,195. *Feb.* 10, 1959. *M. Ganzler and G. Wachtel, assignors to Chesebrough-Pond's, Inc.*

A semi-solid rust inhibiting composition consisting essentially of at least 90 per cent by weight of a petrolatum having a melting point in the range of 100 to 140 degrees F., about 0.1 to 1 per cent of an alkyl phenoxy tetraethoxyethanol in which the alkyl group contains from 5 to 10 carbon atoms, and over 4 per cent of oil-soluble petroleum sulfonates.

Alkyd Resin Coating

U. S. Patent 2,873,210. *Feb.* 10, 1959. *E. J. Barrett, Jr. and D. Flitter, assignors to E. I. du Pont de Nemours and Co.*

A metal article having a multi-layer coating comprising an undercoat and superposed dried topcoat of methyl methacrylate lacquer in adherent contact therewith, said undercoat comprising a baked layer of a coating composition comprising an alkyd resin formed by the reaction of A) a dicarboxylic acid component comprising at least about 25 mole per cent of hexachloroendomethylenetetrahydrophthalic acid (B) at least one of the group consisting of tall oil, semi-drying oils, drying oils and fatty acids derivable therefrom and (C) at least one polyol, said alkyd resin being characterized by having an oil length of about from 20 to 45, an acid number of less than about 50 and unreacted hydroxyl equivalent to about from 0.5 to 5.0 per cent by weight of glycerol based on the total weight of alkyd resin.

Organic Finish

U. S. Patents 2,873,211-12. *Feb.* 10, 1959. *G. P. Roeser, assignor to American-Marietta Co.*

The process of obtaining a durably adhesive protective covering on a metallic sheet which comprises coating said sheet with a copolymer made by copolymerizing in solution in non-reactive organic solvent components A, B and C at a temperature in the range of –20° C. to 150° C. in the presence of a free-radical generating polymerization catalyst to obtain a copolymer which is soluble in said organic solvent and which is thermosetting per se, said components being in proportions in the polymer of about 5-27 mol per cent of component A, 35-59 mol per cent of component B, and 30-52 mol per cent of component C, component A being a compound selected from the group consisting of acrylic acid, methacrylic acid, itaconic acid, crotonic acid, monobutyl maleate, monomethyl maleate, maleic anhydride and itaconic anhydride, and mixtures thereof; component B being a compound selected from the group consisting of acrylonitrile and fumaronitrile, and mixtures thereof; and component C being an acrylate ester; and thereafter heating the coated sheet to temperature in the range of 250° to 600° F. and converting the coating to the thermoset condition in the absence of any extraneous cross-linking agent.

Immersion Deposits

U. S. Patent 2,873,214. *Feb.* 10, 1959. *G. L. Schnable, assignor to Philco Corp.*

The method of displacing a base metal comprising at least one of the metals selected from the group consisting of zinc, cadmium and manganese with a lower melting metal which comprises immersing said base metal in a liquid, non-aqueous bath comprising salt of metal other than the selected base metal and more noble than the selected base metal until at least a portion of said base metal has been displaced by said more noble metal forming an alloy therewith in molten form, said bath being at a temperature

below the solidus point of the base metal and below the solidus point of said more noble metal but above the liquidus point of said alloy.

Organic Coating

U. S. Patent 2,873,215. *Feb.* 10, 1959. *F. K. Quigley, Jr. and H. A. Walters, assignors to The Dow Chemical Co.*

A method for providing iron with an adherent coating which comprises coating a surface of metallic iron with a thin layer of an aqueous colloidal dispersion comprising a polymer of an aliphatic conjugated diolefin, which aqueous dispersion is characterized by a degree of acidity corresponding to a pH value not greater than 5, and drying that layer.

Jet Plating

U. S. Patent 2,873,232. *Feb.* 10, 1959. *E. M. Zimmerman, assignor to Philco Corp.*

In the jet plating of a deposit of metal selected from the group consisting of indium and gallium onto another surface involving directing a stream of electrolyte comprising an aqueous solution of salt of said metal to be deposited against the surface onto which the deposit is to be applied and completing the circuit between the jet device and the surface through the electrolyte stream whereby the said surface is the cathode and the jet device is the anode in the system, the improvement which comprises conducting such plating with a compound selected from the group consisting of ethylenediaminetetraacetic acid and salts thereof dissolved in said electrolyte while maintaining a current density during said plating whereby the plated deposit has a cross-sectional area less than that of the jet orifice.

Method of Electrodepositing Metals

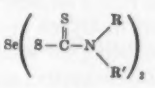
U. S. Patent 2,873,233. *Feb.* 10, 1959. *G. L. Schnable, assignor to Philco Corp.*

The method of electroplating readily-oxidized, difficultly-soldered base metals which comprises immersing said base metal as an electrode in a molten salt bath comprising ions of metal having a melting point below the base metal, said metal ions being in a concentration of at least 0.2 atomic per cent of the cations, iodide ions in a concentration of at least 0.2 atomic per cent of the anions, and fluoride ions in a concentration of at least 0.5 atomic per cent of the anions, at a temperature above the melting point of the lower-melting metal but below the melting point of the base metal, providing another electrode, completing the circuit with the base metal as anode wheerby the base metal is etched and oxide on the surface thereof is removed, reversing the current with the base metal as cathode in said molten salt bath whereby the lower-melting metal deposits thereon in molten form until the desired amount of lower-melting metal has been so deposited.

Bright Copper Bath

U. S. Patent 2,873,234. *Feb.* 10, 1959. *F. Passal, assignor to Metal & Thermit Corp.*

An alkaline-cyanide bath for bright copper plating comprising copper cyanide and, as a brightening agent more than 0.001 g./l. of at least one selenium bisdithiocarbamate having the general formula:

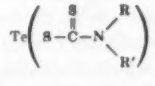


wherein R and R' are selected from the class consisting of hydrogen and alkyl groups having up to six carbon atoms.

Bright Copper Bath

U. S. Patent 2,873,235. *Feb.* 10, 1959. *F. Passal, assignor to Metal & Thermit Corp.*

An alkaline-cyanide bath for bright copper plating comprising copper cyanide and, as a brightening agent more than 0.001 g./l. of at least one tellurium dithiocarbamate having the general formula:



wherein R and R' are selected from the class consisting of hydrogen and alkyl groups having up to six carbon atoms.

Electrostatic Spraying

U. S. Reissue Patent 24,602. *Feb.* 17, 1959. *C. C. Simmons, assignor to Ransburg Electro-Coating Corp.*

A spraying device for providing an expanding spray of coating material radiating from said device as a center; conveyor means including a plurality of spaced article-supports for bodily transporting said articles and positioning them in spaced relation within at least a portion of the spray pattern and along a predetermined arcuate path concave toward the axis of said spraying device, said conveyor means being so constructed and arranged that a plurality of [article-supports] *supported articles* simultaneously lie within said arcuate path and in said spray pattern; and means for maintaining a substantial difference of electrical potential between the articles on said conveyor and said spraying device to cause electrical charging of the spray particles and deposition of the charged particles on the articles.

Cementiferous Paints

U. S. Patent 2,874,057. *Feb.* 17, 1959. *J. E. O. Mayne, assignor to The British Iron and Steel Research Association*

A cementiferous paint for the protection of ferrous metal surfaces consisting essentially of a mixture of zinc dust and an aqueous solution containing at least about 20% of an alkali metal phosphate of the group consisting of, monopotassium dihydrogen phosphate, dipotassium hydrogen phosphate, tripotassium phosphate, a mixture of potassium phosphates, and a mixture of a potassium phosphate and a sodium phosphate, said aqueous solution having a pH value within the range from about 8 to about 9.9 and the weight ratio of zinc dust to said alkali metal phosphate being within the range from 1:1 to 25:1.

Electroless Nickel

U. S. Patent 2,874,073. *Feb.* 17, 1959. *D. E. Metheny and E. Browar, assignors to General American Transportation Corp.*

The method of chemical nickel plating comprising providing a chemical nickel plating solution of the nickel cation-hypophosphite anion type containing a stabilizing amount of lead ion therein.

Self-Hardening Surface Coating Compositions

U. S. Patent 2,874,080. *Feb.* 17, 1959. *O. Schweitzer and E. Bader, assignors to Deutsch Gold-und Silber-Scheideanstalt vormals Roessler*

A method of adhering a self-hardening polymerizable coating composition to a metallic surface selected from the group consisting of copper, zinc,

copper alloys and zinc alloys which comprises applying to said surface a self-hardening polymerizable coating composition containing at least one liquid polymerizable organic compound containing a terminal $CH_2=C<$ group and a relatively small but effective amount of at least one compound capable of forming a complex with copper and zinc selected from the group consisting of hydroxy quinoline, acetyl acetone and benzoyl acetone to improved the bond of the coating composition to said metallic surface.

Electroless Copper

U. S. Patent 2,874,072. *Feb.* 17, 1959. *A. E. Cahill and V. P. McConnell, assignors to General Electric Co.*

An autocatalytic chemical reduction process for continuously plating copper on objects having a catalytic metallic surface comprising the steps of providing an aqueous solution of a complex copper ion, a carbonate radical, a hydroxide radical, formaldehyde, and a complexing agent, immersing an object to be plated in said solution, and copper plating said immersed object by autocatalytic reaction of said solution at the catalytic metallic surface of the object.

Phosphating Process

U. S. Patent 2,874,081. *Feb.* 17, 1959. *W. R. Cavanagh and J. I. Maurer, assignors to Parker Rust Proof Co.*

A method of forming a dried activating composition which comprises the steps of forming an aqueous slurry consisting essentially of a titanium-containing compound and a phosphate of sodium compound, said titanium-containing compound and said phosphate of sodium compound being present in such proportions as to produce a pH of said slurry in the range of about 5.7 to about 7.8, mixing the slurry at a temperature below about 75° F. and thereafter raising the temperature of the mixed slurry for a period of time and at a temperature sufficiently elevated to age the slurry so that a dried activating composition can be evolved therefrom which when dissolved in aqueous solution is capable of activating metal surfaces for subsequent reaction with phosphate coating solutions, and thereafter drying the aged slurry to produce a dried activated composition containing at least 0.005% titanium based on the combined weight of said titanium-containing compound and said phosphate of sodium compound in said dried activating composition.

Pickling Inhibitor

U. S. Patent 2,874,119. *Feb.* 17, 1959. *R. C. Mansfield, J. G. Morrison and C. J. Schmidle, assignors to Rohm & Haas Co.*

A corrosion inhibited aqueous composition comprising an aqueous hydrochloric acid solution containing dissolved therein, in an amount sufficient to inhibit corrosion of ferrous metal surfaces, the reaction product obtained upon heating, for at least one-half hour at a temperature of 45°-120° C., an ammonium halide of the formula RNH_3Cl, where R is a member of the class consisting of hydrogen and the methyl group, with formaldehyde and an olefin of the formula

$$\begin{array}{l} ArC=CH_2 \\ \quad | \\ \quad R \end{array}$$

where Ar is a member of the class consisting of phenyl tolyl, and xylyl groups, and R is a member of the class consisting of hydrogen and the methyl group, there being for each part of the olefin employed in the reaction from 1.5 to 5 parts of formaldehyde and from 1.0 to 2.5 parts of the ammonium compound.

Rust Preventive

U. S. Patent 2,875,072. *Feb.* 24, 1959. *E. A. Dieman and J. W. Gaynor, assignors to Standard Oil Co.*

A rust preventive composition of the slushing oil type characterized by capacity for protecting metal surfaces in acid atmospheres consisting essentially of a hydrocarbon oil as base and containing dissolved therein about 8 to about 12% in combination of a higher aliphatic primary amine containing about 18 to 24 carbon atoms and an aromatic acid, and about 14 to about 28% of zinc naphthenate.

Electroforming Copper Grids

U. S. Patent 2,874,449. *Feb.* 24, 1959. *A. J. de Rooy and J. J. A. Jonkers, assignors to North American Philips Co., Inc.*

A method of forming a copper metal grid comprising the steps, placing a finely meshed metal grid on the surface of an insulating support, coating said surface and metal grid with a thin layer of a finely-divided soluble crystalline material, removing the grid thereby removing the crystalline material that had been on the grid surface and exposing portions of the insulating support surface corresponding to the grid, coating the layer of crystalline material and exposed surface of the insulating support with a thin layer of metal, immersing the insulating support in a solvent for said crystalline material until the solvent has penetrated through the metal layer and has dissolved the crystalline material, removing the dissolved crystalline material and metal not adhering directly to the surface of the insulating support thereby forming a metal print of said network on the insulating support, electrodepositing on said metal print a layer of copper of sufficient thickness to form a rigid copper grid and removing the thus formed copper grid from the insulating support.

Hot Dip Galvanizing

U. S. Patent 2,875,096. *Feb.* 24, 1959. *W. L. Diehl and H. S. Bell, assignors to Wheeling Steel Corp.*

In the hot dip galvanizing of continuous metal strip in which the strip is delivered upwardly out of the galvanizing bath of molten spelter between exit rolls partly immersed in the bath engaging the respective faces of the strip and arranged with their axes parallel and generally horizontal and in which the strip moves at a speed at which the spelter tends to be carried along with the strip by capillary attraction, the step of inhibiting the carrying up out of the bath of an excessive amount of molten spelter which comprises engaging the upwardly moving strip in the bath before the strip reaches the exit rolls, at a location close enough to the exit rolls that substantial capillary attraction of the spelter to the strip cannot be set up between that location and the exit rolls, by capillary attraction reducing rolls only and thereby inhibiting the clinging of spelter to the strip.

Phosphating Bath

U. S. Patent 2,875,111. *Feb.* 24, 1959. *C. F. Wilkinson, H. A. H. Jenkins, L. T. Lake and S. V. Radcliffe, assignors to Parker Rust Proof Co.*

A method of forming a phosphate coating on wire which comprises the steps of passing the wire in a chemically clean condition, continuously in an axial direction through an aqueous acidic accelerated phosphate coating solution selected from the group con-

sisting of zinc, manganese, iron and cadmium phosphate solutions and having a pointage greater than about 40 and containing an accelerator selected from the group consisting of nitrite, nitrophenol, nitroguanidine, a mixture of chlorate and nitrate and a mixture of nitrite and nitrate, the ratio to phosphate of said accelerator being in the range of 0.0075 to 0.6, regulating the speed of travel and the duration of immersion of the wire in the solution with the degree of acceleration so that the initial formation of the coating occurs in the coating solution and the wire emerges from the coating solution carrying a uniform film of the solution on its surface, which film serves to complete the formation of the phosphate coating on the surface of the wire.

Electroless Nickel

U. S. Patent 2,876,116. *Mar.* 3, 1959. *H. J. Jendrzynski, assignor to General Motors Corp.*

In an aqueous electroless nickel plating bath containing nickel ion and hypophosphite ion, the improvement which consists of including in said bath a small but effective amount of a molybdenum compound which is soluble in said bath to inhibit the decomposition of said bath while allowing the nickel plating reaction to continue the concentration of said molybdenum compound being such as to provide a molybdenum content in said bath of up to .02 gram per liter.

Hot Dipping Steel Tubing

U. S. Patent 2,876,132. *Mar.* 3, 1959. *D. P. Worden and W. H. Janneck, assignors to General Motors Corp.*

The continuous method of coating steel tubing with a layer of non-ferrous, anti-corrosive and protective metallic coating which comprises successively applying to the tubing as it is moved longitudinally a relatively dilute sulfuric acid bath containing approximately 12% and 25% sulfuric acid by volume through which direct electric current is passed in such a manner that the tubing constitutes an anode, directing jets of water over the tubing after application of the acid bath to reduce the temperature of the tubing and to remove any excess of acid remaining on the surface thereof, then applying to the moving tubing a flux consisting essentially of approximately 30% to 75% by weight zinc chloride and the balance water, subsequently applying a lead alloy coating to the moving tubing while maintaining the lead alloy at a temperature above its melting point, directing cooling water over the surface of the tubing after application of the coating layer thereto in order to cool the tubing and solidify the coating material on the tubing surface.

Organic Coating

U. S. Patent 2,876,135. *Mar.* 3, 1959. *M. Levine, assignor to Pittsburgh Plate Glass Co.*

A coating composition comprising a solvent having dissolved therein from 60 per cent to 80 per cent by weight of the resinous components, of a short oil alkyd resin having an acid number of about 35 to 50, from 20 per cent to 40 per cent by weight of the resinous components, of a vinyl resin which comprises a copolymer of a vinyl halide and a vinyl ester of a saturated aliphatic monocarboxylic acid, and from 5 per cent to 15 per cent by weight of the resinous components, of an amine-aldehyde resinous condensation product.

Gas Plating

U. S. Patent 2,876,137. *Mar.* 3, 1959. *F. E. Drummond, assignor to The Commonwealth Engineering Co. of Ohio*

A method of providing a metal body with an outer shell or layer of magnesium metal, which comprises the steps of cleaning the surface of said metal body, heating the resultant cleaned metal body in a dry, inert atmosphere and thereafter subjecting said heated body to an atmosphere comprising a heat-decomposable organometallic compound of said magnesium selected from the group consisting of the alkyl and aryl compounds of magnesium and maintaining the temperature sufficient to cause decomposition of the compound and deposition of the magnesium metal constituent onto the metal body and deeply into the pores and interstices of said metal body and without the inclusion of impurities.

Sulfide Conversion Coating

U. S. Patent 2,876,150. *Mar.* 3, 1959. *F. Singer*

The method which comprises contacting the surface of a ferrous article with a composition consisting essentially of water and ammonium thiosulfate until a tightly adherent coating of sulfurized iron is formed on said surface.

Gas Plating

U. S. Patent 2,876,138. *Mar.* 3, 1959. *R. L. Doerr, assignor to Olin Mathieson Chemical Corp.*

In the process of applying continuous even coatings of metals to light metals by applying a solution of a metal salt to the light metal and heating the metal to a temperature and for a time sufficient to coat the metal, the step of applying to the light metal to be coated a solution which consists essentially of (1) a mixture of (*a*) a mixture of about 10 to 90 weight per cent of stannous chloride and about 10 to 90 weight per cent of a pyrazoline hydrohalide and (*b*) a zinc chloride complex salt of a pyrazoline hydrohalide and (2) about 10 to 50 weight per cent, based on the stannous chloride and zinc chloride of a nitrogen salt component selected from the group consisting of a hydrazine hydrohalide and a mixture of a hydrazine hydrohalide and an ammonium halide, the halide in said hydrazine hydrohalide and ammonium halide being selected from the group consisting of chloride and bromide, and a carrier selected from the group consisting of lower aliphatic monohydric alcohols and lower aliphatic dihydric alcohols.

Pickling Titanium and Zirconium

U. S. Patent 2,876,144. *Mar.* 3, 1959. *H. B. Bomberger and M. B. Vordahl, assignors to Crucible Steel Co. of America*

An aqueous solution for pickling titanium, zirconium and alloys of each with removal of basis metal from the surface without attendant hydrogen embrittlement, comprising in percentages by weight, about: 0.5 to 10% phosphoric acid, 0.5 to 10% of fluoride ions, and at least one member selected from the group consisting of 15 to 50% nitric acid, 5 to 35% hydrogen peroxide, and 2 to 40% nitric acid together with 0.5 to 30% hydrogen peroxide.

Paint Base

U. S. Patent 2,877,130. *Mar.* 10, 1959. *M. Caron and R. E. Etheridge, assignors to Walter B. Jamieson*

A liquid transparent paint base having no hiding power and suitable for mixing with a liquid pigment concentrate to provide a paint giving hiding

power, consisting essentially of a hiding-pigment-free dispersion of from 22% to 56% by weight of extender pigment in a film forming vehicle and a solvent for said film-forming vehicle, and said film-forming vehicle being selected from the group consisting of drying oils, resins, and mixtures of drying oils and resins present in an amount such that the base has a solid content within the range of from 12% to 40% by weight, the base having a P.V.C. within the range from 20% to 62%.

Wire Plating Machine

U. S. Patent 2,876,191. *Mar.* 3, 1959. *R. J. Bachman, assignor to Western Electric Co., Inc.*

An apparatus for electroplating moving wires, which comprises a series of electrolytic cells aligned in tandem so that a plurality of wires may be continuously advanced therethrough in parallel, side-by-side relationship.

Magnesium-Zinc Paint Pigments

U. S. Patent 2,877,126. *Mar.* 10, 1959. *L. Whitby, assignor to The Dow Chemical Co.*

1. A pigment for pigmenting coating compositions, said pigment consisting of an admixture of (*a*) between 80 and 20 per cent by volume of a particulate binary alloy consisting of magnesium in an amount between 30 and 15 weight per cent and zinc in an amount between 70 and 85 weight per cent and (*b*) between 30 and 80 per cent by volume of a chromate selected from the class consisting of chromates of zinc and alkaline earth metals.

ABSTRACTS

Embrittlement of Steel due to Pickling and Electroplating Treatments

By U. Tragardh. Paper read at the 6th. International Congress of Engineering Fabrication, Paris.

The author presented details of a study of the variations of ductility of carbon steels after the adsorption of hydrogen, by determination of the number of "folds" still possible after this adsorption. The tests were conducted on the Amsler test apparatus in which the test parts were bent from one side to the other over 90°, the test being stopped when the test parts showed signs of rupture.

When the embrittlement effect is very high, rupture can occur even before the first folding at 90°. The author then utilized the test method developed by C. A. Zapffe, in which the test sample is bent along a graduated scale at a constant speed of 2° of arc per second. The angle is read at the moment of rupture.

As the test materials, there were used three types of carbon steels contained respectively 1.40%, 1.07% and 0.7% of carbon. The three steels were hardened and annealed. The effects of annealing on the grain structure were shown in detail; the amount of occlusions (particularly manganese sulfide and silicates) was normal, with no traces of temper cracks.

The quantity of hydrogen adsorbed or its speed of diffusion in the steel are without direct relation to the embrittlement and cannot be utilized as criteria of the tendency to embrittlement.

Zinc being the metal usually employed as a coating on steel against corrosion, the acid and alkaline baths were studied in particular. A number of curves were presented, representing the diminution in percentage of the number of test folds according to the different cases; the data embodied in these curves may be summarized as follows:

The hydrogen embrittlement of steels after coating with zinc by electroplating indicated a marked variation as a function of the preparatory treatment. After heating and, likewise, after storage, embrittlement was increased. Minimum hydrogen embrittlement was obtained after pickling in nitric acid followed by plating in a perchlorate bath; figures were also given covering the results obtained in the case of chromium plating.

Electroplated coatings of tin or silver were found to give a low embrittlement, while plated coatings of cadmium or copper increased hydrogen embrittlement appreciably, as with zinc.

Electroplated Coatings of Tin-Nickel Alloys and Their Recent Applications

By M. P. Dehais. Paper read at the 6th. International Congress of Engineering Fabrication, Paris.

This alloy contains 65% tin and 35% nickel, and is deposited from a bath of the chloride-fluoride type. The anodes can be either tin-nickel alloy or else two separate anode circuits can be employed with tin and nickel anodes. The alloy, which is deposited directly in the bright form, has the formula NiSn. The metal, accordingly, is present in a single phase and contains neither free tin nor free nickel. The thermal tin-nickel equilibrium diagram indicates the presence of several intermetallic compounds but not that of the formula NiSn. It is a question here, therefore of a metastable compound.

In the present case, excellent stability of the alloy is assured since its recrystallization temperature is of the order of 300°C. Consequently, if the deposit is utilized at a lower temperature, it remains perfectly stable. X-ray examinations of deposits several years old, show no modification of structure.

The crystalline structure of this alloy, studied by X-ray diagrams, is analogous to that of the gamma phase or, more precisely, gamma Ni_3Sn_2, but the lattice dimensions are different. As is the case for the majority of bright deposits, a preferential orientation of the crystals was confirmed.

The hardness of the deposit is intermediate between that of nickel and chromium, which is somewhat remarkable for an alloy containing 65% tin. The alloy has a warmer tint than that of nickel or chromium, with a slightly pink reflection.

The following conclusions were drawn from extensive corrosion tests:

1. Tin-nickel deposits preserve their brilliance on exposure to weather as well as normal nickel-chromium deposits.

2. Tin-nickel alloy coatings are less subject to tarnishing than the nickel-chromium deposits when sheltered from rain.

3. Regular and frequent wiping largely contributes to preserving the initial bright aspect of the two types of coatings.

4. Tin-nickel coatings can be less porous than the normal nickel-chromium deposits of the same thickness and show corrosion pitting to a lesser extent after long service.

5. The corrosion at the pores of the coating can be more severe with the tin-nickel alloy than with the normal nickel-chromium, but the tin-nickel coating often shows better between two wipings from the fact that the corro-

sion spots remain of small size instead of spreading all over the surface.

6. Salt spray tests of short duration do not give results corresponding to real external conditions, but long-term tests can be satisfactory.

Chemical and Electrolytic Dechroming of Copper

W. Schlittgen, *Metallwarenindustrie und Galvanotechnik*, **49**, #2, 53-57.

In de-chroming copper printing rolls, a series of tests was made to ascertain the relationship between stripping duration and attack on the basis metal; also the operating conditions, a study of general interest in normal metal plating practice, employing chromium plating and stripping techniques.

Hydrochloric acid with an equal volume of water was used for chemical stripping. The test parts were preheated to the test temperature and immersed in the bath without agitation. It was found that the stripping rate increases with temperature. The optimum temperature was found to be 50°-60°C. and the end of the reaction can easily be ascertained by cessation of hydrogen generation.

For electrolytic stripping of the copper printing rolls, an 8% caustic soda solution was used, with and without the addition of wetting agents. It is known that the use of wetting agents simplifies electrolytic dechroming very considerably, and eliminates the need for fume-extraction equipment. With an electrolyte temperature of 20°C., the current density was varied between 2 and 22 amp./dm.^{2}

It was found that the stripping rate is not proportional to the current density but that, with rising current density, the influence of the current density-increase falls off. For practical conditions, the optimum current density was 10-15 amp./dm.^{2}, and any increase above this figure brings no advantage with regard to reduction of the processing time.

Attack on the basis metal is of great importance in electrolytic dechroming because completeness of stripping can be ascertained only from the appearance of the work. The tests showed that the copper base attack was about proportional to the current density employed. It was found also that, contrary to the technical literature, there is a slight reduction in attack on copper at higher temperatures.

Baths for Surface Finishing of Engineering Parts by Electropolishing

J. Bergere and R. Mondon: Paper read at the 6th. International Congress of Engineering Fabrication, Paris.

The bath most popular for electropolishing steel parts for the auto industry, etc., is the sulfuric-phosphoric bath, which contains variable proportions of sulfuric acid, phosphoric acid, and water to which chromic anhydride is sometimes added. These baths function between 50° and 90°C.

Electrical conditions vary according to the nature of the metal being treated and the composition of the solution. In general, the current density is high, of the order of 20 amp./dm.^{2} and up to 100 amp./dm.^{2} Treatment time depends on the initial state of the surface, the electrical conditions and, finally, the polish desired. The compositions of the electropolishing baths can be adapted to the type of metal being treated and to the objective required.

Examples of various baths and treatments are as follows: (a) Stainless and carbon steels (low alloy): Concentrated mixtures of sulfuric acid and orthophosphoric acid in variable proportions. (b) Aluminum and its alloys: A ternary mixture of sulfuric acid—phosphoric acid — chromic anhydride. (c) Copper and its alloys: Mixture of phosphoric acid and chromic anhydride. The "superfinishing bath" for precision polishing of engineering parts of ordinary or of special alloy steels: mixture of phosphoric acid and chromic anhydride to saturation.

Engineering practice with electropolishing techniques, as described in this paper, was conducted at the Italian works of the Hispano-Suiza-Jacquet concern. This company took over the Jacquet electropolishing patents for the development of this process on a large scale, for the treatment of engineering parts used in large quantities in the automobile industry.

For some years now, industrial electropolishing, which was at first limited to only a few decorative applications, has found a growing application in mechanical engineering practice, thanks to the flexibility offered by its employment, which permits either micro-geometric improvement of the surface state of the metal or an actual modification of the dimensional shapes comparable to a machining process on a machine tool, and which is often more easy to realize than by normal mechanical means.

Air-Drying, Unsaturated Polyester Resins for Lacquer Finishes

W. Geilenkirchen: *Farbe und Lack*, **64**, #10, 528-537.

These new air-drying polyester finishes show good brilliance after drying and good surface characteristics. The products can be used either as clear or pigmented finishes. Very satisfactory results have been obtained with the brilliance retention of the film under weathering conditions. Broadly, these air-drying, unsaturated polyester resins, show outstanding weathering characteristics.

For application to sheet metal surfaces, a primer is used, consisting of a combination of an unsaturated polyester resin and a di-isocyanate finish. This serves to provide the required adhesion to the metal surface. The air-drying, unsaturated polyester resin finish is then applied as the cover coat. Such a combination is perfectly suitable for full exposure to outdoor weathering conditions.

As the polyester finishes are very resistant to water, acids, weak alkalies, alcohol, and various solvents, they offer many advantages for applications where nitrocellulose lacquers have been employed. They are finding increasing application in the finishing of kitchen and bathroom furniture, etc. As the wear-resistance of the finish is of particular significance for these applications, some tests were conducted in this connection. Comparative tests were conducted with a cold-hardening epoxy finish, an air-drying unsaturated polyester finish, and a di-isocyanate finish. The best results in this respect were given by the last; the uniform through-hardening of the polyester lacquer film was clearly demonstrated by the tests. The wear resistance values of the air-drying polyester lacquers were more favorable than the cold-hardening epoxy finishes, and were greatly superior to a commercial amber varnish.

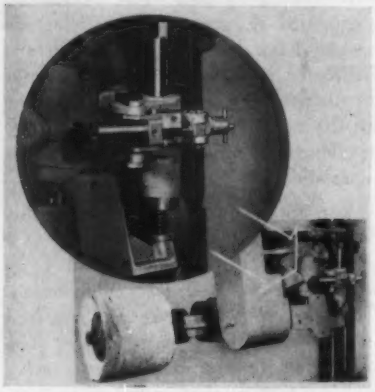
These air-drying polyesters can be used either as clear or pigmented finishes. The pigmented finishes have given very good results in lacquering polyester fiberglass products, such as car and truck bodies. The adhesion of a pigmented polyester lacquer is exceptionally good on this surface.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Buffing Wheel Wear Compensator

Murray-Way Corp., Dept. MF, P.O. Box 180, Birmingham, Mich.



A new feature accessory which accurately compensates for work wheel wear is now available with all the above manufacturer's polishing and buffing heads, making use of an electrical jog button which lowers the work wheel. When the operator sees that the polishing or buffing head is not operating at full efficiency, he merely pushes the jog button. Each jog lowers the work wheel a pre-determined distance.

Jog buttons may be located near the working heads for visual checking and adjustment, or they may be located on a remote central control panel with ammeters to indicate motor load. The latter enables one operator to control all work heads from one position.

Work Holding Process

Colorward Process, Dept. MF, 4515 Superior Ave., Cleveland 3, Ohio.

A revolutionary new work holding process is designed to cut preparation time and increase efficiency in the plating of small objects. Platers and metal finishing companies working with products for which firm or rigid contact is required to provide sufficient electrical current, will benefit most by the process.

Parts to be treated by the Colorward process are loaded and unloaded by means of an air-operated piston, mounted in line with holes or apertures of the parts, which forces a rod and a strip of spring metal through the holes. Dimensions of both the strip and rod are pre-determined so that, when the rod is forced through the holes of the parts, an arc is formed laterally on the strip, resulting in a three-point contact on each part between the two sides of the strip and the radius of the rod. Each three-point contact is separate and individual, due to the variable spring tensions placed on the spring strip by the rod as it is forced through the hole of the individual part. This individuality of contact compensates for the common tolerance permissible in commercial blanking.

A large quantity of loaded rods can then be fixed to a specially-designed rack which occupies a considerably smaller area of space than the equipment now in use in plating and metal finishing plants. As a result, a large number of parts can be handled economically and easily.

Process may be licensed on a volume or monthly basis. Engineering service is provided for each licensee in accordance with its present equipment and customers' needs.

Sheet Polishers

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Rd., Detroit 20, Mich.

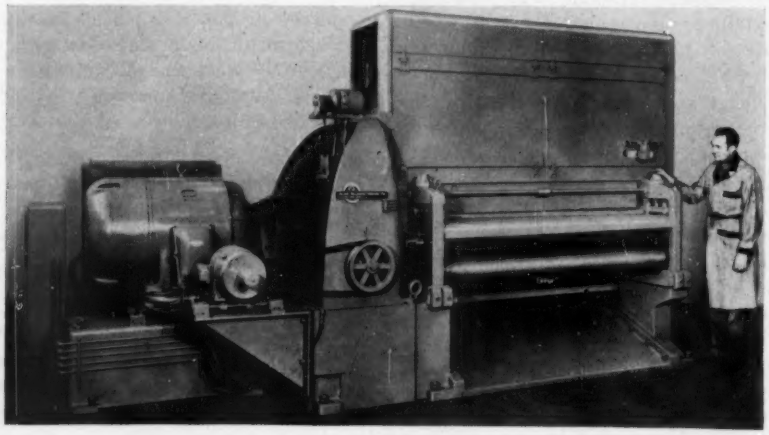
New sheet polishing mills are stated to provide a continuous automated method for performing abrasive belt-finishing operations on metal sheets and plate from 3-ft. long and up as well as coils at feeds from 20 to 60 fpm.

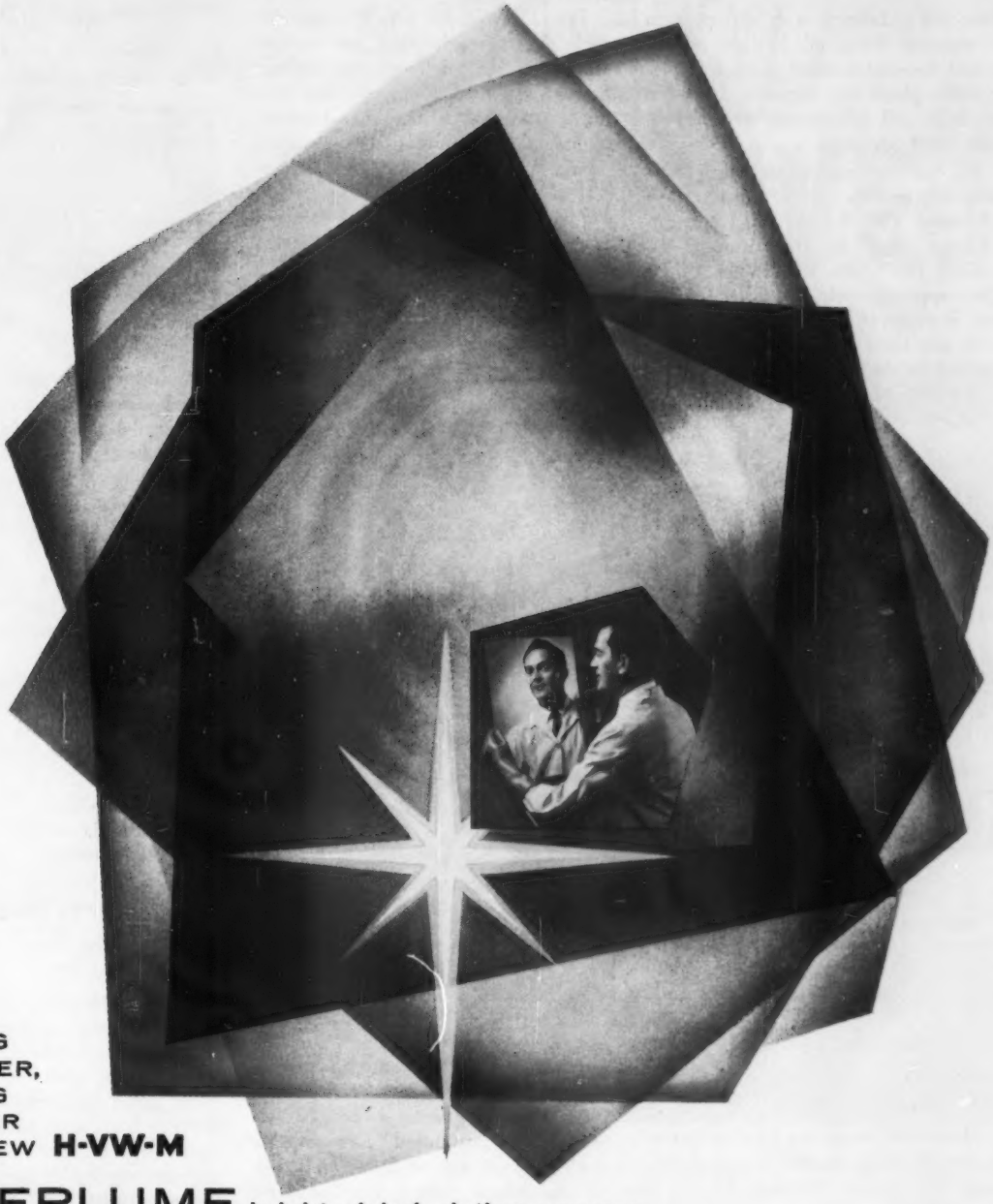
These machines have four main operating components: an idler roll, a contact roll, a billy roll and pinch rolls. An abrasive belt is supported by the contact and idler rolls. The contact roll is driven by the main drive motor through a V-belt drive. An air cylinder raises and lowers the idler roll assembly to maintain belt tension. Oscillation and tracking of the belt is achieved by pivoting the idler roll with an air cylinder mechanism controlled by an externally mounted electric eye.

The sheet or plate material to be finished is traversed through the mill between the contact and billy roll by individual assemblies of four pinch rolls, one set ahead of and the other behind the contact roll. The pinch rolls are driven in either direction by a separate motor through worm gear transmissions and flexible couplings.

The billy roll provides the work pressure. It is adjusted by air or hydraulic cylinders to provide the desired pressures. Pushbutton and valve controls for operating and adjusting the mill functions are in a panel at the end of the machine.

The mills have a number of design features that provide maximum operating precision. They have large-diameter extra heavy-duty pinch rolls, a true-running dynamically-balanced contact roll spindle, automatic oil-mist lubrication, worm gear pinch roll drives,





NOTHING SMOOTHER, NOTHING BRIGHTER THAN NEW **H-VW-M**

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Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

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Progress in metalfinishing through advanced processes • equipment.

idler roll stabilizers, a drive motor on a separate base, all outside adjustments, fail-safe floating pinch rolls, adjustable pinch roll pressure, fore and aft billy roll adjustment and adjustable sheet pressures.

Typical standardized units are made to handle stock widths of 30, 40, 54 or 74 inches. The 74 inch model illustrated has a 150-hp main drive motor and a 75-in. belt width. It occupies a floor space approximately 5½ ft. by 16½ ft. and is about 9 ft. high. When 74 in. mills are lined in tandem for a continuous finishing operation, the center-to-center distance between the units is 6-ft., 3-inches.

Paint Stripper

Dytex Chemical Co., Dept. MF, 140 India St., Providence 3, R. I.

Stripex #153 is a paint stripper said to be excellent for vacuum metalizing racks and other baked finishes.

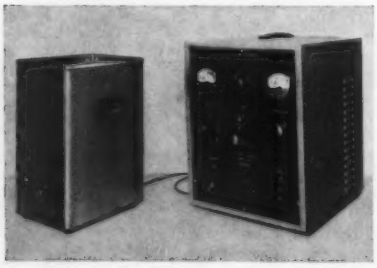
No heat is required. Its penetrating properties and swelling action destroy the adhesion of coatings to metal. It is not recommended that the material be diluted, as the time of immersion depends on the nature of the coating being stripped.

After removing the work from the stripping bath, it may be rinsed to remove loose clinging particles. A water seal is recommended for decreasing the volatility of the stripper. The water lays on top of the stripper as a blanket, according to the manufacturer, and keeps the solution from evaporating.

Ultrasonic Cleaning Unit

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington, N. J.

Model 240 features a 5-gallon heavy-gauge polished stainless steel tank 12″ long, 12″ deep and 9″ wide. 44½% of the tank bottom is covered with driv-

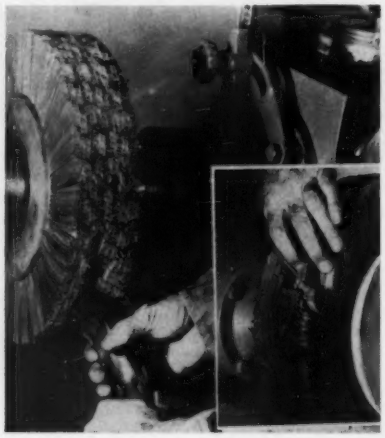


ing elements. This is more extensive coverage than is provided in most ultrasonic cleaners. Actual radiating surface is 48 square inches.

The 115-volt AC single phase 60-cycle generator, designed for continuous operation, delivers an average power output of 250 watts and produces peaks of 1000 watts. Features include 0-60 minute timer, one tube oscillator, provision for remote control of equipment, front panel switching which permits a choice of either of two transducers and circuit breaker and 3-wire ground protection. The forced-air cooled unit can be adjusted to available line voltage by means of a front panel switch. A generator which operates at 230 volts can be supplied. Model 240, which is in stock, is priced at $990.00.

Abrasive Wheel

Merit Products, Inc., Dept. MF, 3691 Lenawee Ave., Los Angeles 16, Cal.



To give greater flexibility for cleaning and polishing contoured metal parts, a "slashed" version of the Grind-O-Flex flexible grinding wheel has recently been introduced. The abrasive cloth "leaves" are cut into thin strips. As the wheel rotates the "abrasive fingers" mold to irregular shapes and get down into places which formerly could only be finished by hand. Wheel sizes are 14″ and 16″ diameter and widths are available from 3″ to 60″. Grits available are #50 to #320 aluminum-oxide cloth.

These wheels are claimed to be equally as effective on soft metals as on hard. Ideal for satin finishing aluminum as well as stainless steel, the abrasive wears evenly, a new cutting edge always presents itself, and the wheel never needs to be dressed. New abrasive loadings are inserted into the slotted hub.

Open Top Dryer

C. S. Blakeslee & Co., Dept. MF, 1844 S. Laramie Ave., Chicago 50, Ill.

A new open top dryer, for drying plated parts on racks after rinsing, has a recirculating hot air system designed so that there is little or no heat or air loss through the top opening. Small nozzles, placed at close intervals on the side of the drying chamber, direct streams of warm air on all parts for fast, efficient drying. A sliding damper which is located on the side of the dryer regulates the flow of secondary air.

The dryer can be designed to fit any job requirement. The size of the plating rack, the position in which work is hung, and the number of plating racks to be handled at one time will determine the size.

The unit is available in steam or gas-heated models.

Epoxy Stripper

Enthone Inc., Dept. MF, 442 Elm St., New Haven, Conn.

Stripper S-28, the second in a series of chlorinated strippers for epoxy enamels which can be diluted with water, strips synthetic enamels rapidly at room temperature and at dilutions as high as 1 part stripper to 20 parts of water. It is very economical to use compared with conventional chlorinated strippers which are not miscible with water and which must be used full strength. Either Stripper S-28 or its companion product S-26, will strip any epoxy or epoxy-ester combination.

The stripper is a non-flammable, liquid product which does not contain phenol or phenolic compounds. It is formulated with chlorinated solvents and organic penetrants which detach and wrinkle baked epoxy coatings from most basis metals including steel, aluminum, copper, brass and zinc die castings.

The stripping solution is readily maintained by periodic additions. Since

the stripping solution wrinkles the coating instead of dissolving it, it does not become contaminated with dissolved enamel and has long life.

Low Temperature Phosphating Compound

Turco Products, Inc., Dept. MF, 24600 So. Main St., Wilmington, Calif.

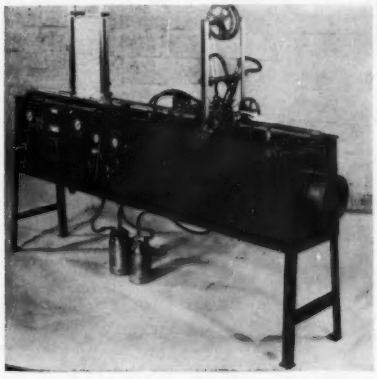
When operated at 95°F., the new product, Turcoat Low Temp, provides a paint gripping zinc phosphate coating on iron, steel or zinc equal to those provided by phosphating processes requiring operating temperatures up to 180°F., it is claimed.

When used as a bond for paint, it provides a uniformly smooth coating of up to 200 mg/ft.^{2} in two minutes at 95°F. When used as a base for corrosion prevention, the new product provides up to 1100 mg./ft.^{2} coating in 10-15 minutes at 95°F. It can be applied by immersion or spray washer, and is said to effect savings of approximately 75% in steam, water, electricity and "down time" costs alone.

Automatic Spray Coater

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A completely automatic machine rapidly applies coating compounds to small articles, such as electrical and electronic components, at a rate of 4000 per hour. The coating is confined to the desired area by two accurately spaced traveling masking strips, while racks loaded with parts move continuously through the spray station.



Automation is practical, inasmuch as the coating material is confined by remote masking and not mechanical means, thus eliminating the use of spray masks, registering devices and mask cleaning operations.

NEW EXCLUSIVE!

ATLANTIC GREASELESS COMPOUNDS

WITH K-134

The miracle additive newly discovered and developed by Atlantic's research laboratories

- REDUCES APPLICATION TIME
- ADHERES BETTER TO BUFFING WHEELS
- CUTS DOWN COSTLY WASTE
- ASSURES UNIFORM SATIN FINISH

Order NEW Atlantic Greaseless Compounds with Additive K-134 for faster, more economical buffing and polishing; and for longer-lasting, higher quality finish of metals, plastics and wood.

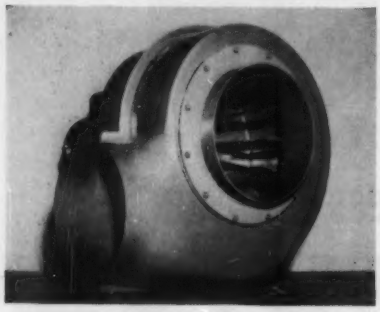
Devoted exclusively to producing unexcelled greaseless compounds, Atlantic maintains constant research to continually improve its products. The dependable uniformity of Atlantic compounds is assured by the highest grade ingredients and efficient quality control. Technical assistance and data available on request.

THE ATLANTIC COMPOUND CO.

6 CHARLES ST., CHELSEA 50, MASS.

Corrosion-Resistant Blowers

Industrial Plastic Fabricators Inc., Dept. MF, Endicott St., Norwood, Mass.



A new line of direct-drive, corrosion-resistant utility blowers especially designed for use in laboratories where corrosive fumes or moisture are a problem, is constructed of unplasticized rigid polyvinyl chloride. Available in three models with ⅓, ¾ or 1 h.p. motor and in capacities from 399 to 2000 cfm, these units are equipped with a rigid PVC housing and PVC multi-blade wheel.

The PVC Utility Blowers have PVC drain connections and pedestals coated with a polyvinyl paint. Other standard features of the units include light-weight construction and full ball-bearing motors. All models are designed to withstand temperatures as high as 140°F. at the blower inlet. In addition to direct-drive units, belt-drive blowers are also offered.

Buffing Compound Remover

Conversion Chemical Corp., Dept. MF, Rockville, Conn.

Kenvert Sluff-Off X is a synthetic detergent for removing buffing compounds by soak or ultrasonic cleaning from all metals without attack. This new product is water soluble and removes buffing compounds which may be high in tallow, or where there are oily conditions, from a wide variety of metals including steel, copper, brass, aluminum, nickel, silver and zinc die castings. It is particularly effective on stubborn compounds which have impacted overnight and weekends. Also, it readily removes compounds from aluminum and zinc which have combined chemically to form metallic soaps. Treated ferrous parts have a tendency to resist rusting, which is advantageous in many applications.

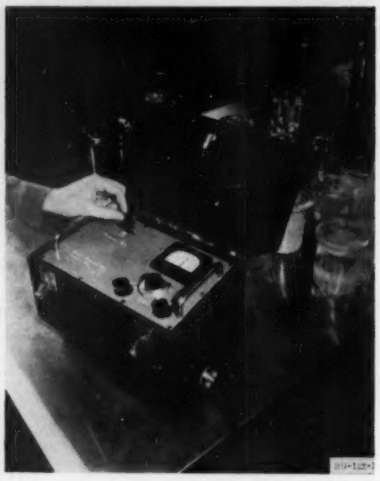
There are several interesting applications for this new product. One is its use for removal of soldering fluxes as it is non-staining. Another is its use for ultrasonic cleaning applications and removal of impacted compounds, because it possesses excellent energy transmission qualities.

Cleanliness Tester

Branson Ultrasonic Corp., Dept. MF, 40 Brown House Rd., Stamford, Conn.

Model CM-1 tester makes it possible to assign numerical values to surface cleanliness where non-bonded soils are involved. For example, it will measure smut residue after pickling of steel. In addition, the tester may be used to evaluate: 1) detergents and oils used on cold mills; 2) annealing furnace performance; and 3) efficiency of electrolytic and alkaline cleaning lines.

The tester has a linear scale from



0 to 1000, where 1000 indicates absolute cleanliness. Accuracy of one part in a thousand is made possible by a ten-turn potentiometer in the balancing circuit. The test is more exact than methods formerly used, such as the water-break and wipe tests, it is claimed.

Testing involves only two steps:

1) Soil is removed from the surface under test with transparent, pressure-sensitive tape, which is then affixed to a 25 x 75-mm microscope slide.

2) Optical density of the composite (tape, soil, and slide) is measured by the tester, which is actually a densitometer designed specifically for that purpose. Readings are direct and give a numerical value for cleanliness.

The unit measures 12 x 14 x 8 in. It weighs only 18¼ lbs, and is easily transported. Power drawn is 50 watts at 110 v., 60 cycles. Slide holder, microscope slides, and tape are supplied with the instrument.

Solvent Emulsion

Heatbath Corp., Dept. MF, Springfield 1, Mass.

A new solvent emulsion detergent, known as Pen Sol #2, has a dual purpose: to clean and protect metal in one operation. It can be considered as a combination of an emulsion, rust-proofing oil and cleaner.

Normally this material is used 1 to 2% with water at room temperature. It may be employed as a soak cleaner or in single or multiple stage washers. When used hot, it is an excellent cleaning agent, removing drawing compounds, shop soils, oils, and metal chips.

Among the advantages offered are good cleaning, corrosion protection, easy removal, safety and economy, it is claimed.

Roll-Type Cover for Vapor Degreasers

Baron Industries, Dept. MF, 241 West Ave. 26, Los Angeles 31, Cal.

"Econ-O-Lid" is a roll-type cover that attaches easily to vapor spray degreasers of every size and manufacture. Featuring both simplicity and economy of operation, it is conveniently mounted on the top of the degreasing machine and permanently replaces the need for the old-fashioned bulky steel covers.

With a simple flick of the finger, the new lid rolls across the top of the machine to a completely open or closed position. When in the closed position, solvent vapors are locked inside the machine where they belong. Since vapors cannot escape, the need for

continually adding costly solutions to maintain proper solvent levels is eliminated. When rolled back to the open position, the new degreaser lid gives full access to the work area, because it takes no additional machine space.

Durably constructed to give long

life, dependable service, the cover is made of a tough, specially coated material that is resistant to all trichlorethylene solutions. With standard widths ranging from 24″ to 42″ and lengths from 3 ft. to 10 ft., prices start at just $45.00.

Curtain-Type Coating Machine

Gasway Corp., Dept. MF, 4343 N. Ravenswood Ave., Chicago 26, Ill.

This new machine, called the Electric-Kurtain Coater, incorporates a unique method of producing the falling curtain of paint. Instead of an orifice type of fountain, the machine is based on the principle of a weir or dam over which the material flows to produce the curtain. This permits a stream of coating material which is accurately controlled by variable flow rates. Coating thicknesses may be varied from ½ mil to 25 mils or more as desired.

The coater can be set up for operation with two adjustments only — one for conveyor speed through the machine and one for pump speed which regulates the curtain speed. These adjustments are indicated by a conveyor speed tachometer and a pump pressure gauge. Thus, any previous setting may be repeated with accuracy.

Most coating materials, including paints, varnishes, lacquers, stains, sealers, etc., can be applied without requiring special formulation. Coating efficiency approaches 100% because material is continuously recirculated from a reservoir. A small solvent loss occurs due to slight evaporation in the curtain itself. By running work pieces through the coater at suitable angles, it is possible to coat as many as three sides per pass. Maximum thickness of work is 8″.

Each machine is equipped with a permanent, self-cleaning filter and incorporates an interchangeable and portable paint system which eliminates the need for tedious color change-over operations. It is possible to change

No matter what the job...

There's a Luster-on® Chromate Conversion Coating to fill your Specifications

FOR BRILLIANT, CORROSION-RESISTANT FINISHES . . . rivaling chrome for many applications where cost is a factor . . . long-lasting, easily controlled applications.

FOR CLEAR AND IRIDESCENT COATINGS . . . most attractive appearance where corrosion-protection, humidity, handling are involved during processing . . . at extremely low cost.

FOR DECORATIVE COLOR . . . on economical zinc . . . scintillating golds, yellows, blues, greens, violets, reds, brass and copper hues.

FOR ALUMINUM . . . where the surface hardness of anodizing is not required.

FOR LASTING BRIGHTNESS . . . on copper and brass without noxious fuming.

FOR DIE CASTINGS . . . uniform, low cost finish ideal for later painting.

LUSTER-ON means economy! LUSTER-ON proved formulas mean excellent operating control!

Data Sheets and Prices on Request

The Chemical Corporation

58 Waltham Avenue, Springfield 9, Mass.

West Coast:
Crown Chem. & Engr.
Los Angeles & San Francisco

Canadian Licensee:
Alloycraft, Ltd.
Montreal

colors and finishes in a few minutes' time. The conveyor speed range is infinitely variable between 50 and 450 f.p.m.

All controls and gauges are located on the same side of the machine and all rolls are dynamically balanced to assure smoothness.

There are four different sizes in the new line for coating up to 65" wide. All machines are furnished with 3 HP. 220-440 V. 60 cycle explosion-proof motors. Other voltages and cycles will be furnished on special order. Left hand machine is the standard assembly, but right-hand machines are available when specified. Conveyor length is 7 ft. for infeed, 5 ft. for outfeed. The machine is furnished with variable volume hydraulic drive on conveyors and fluid pump. Reservoir is 15 gallon capacity.

Pickling Inhibitor

O'Brien Industries, Inc., Dept. MF, P. O. Box 72, Caldwell, N. J.

O'Bhibit-L 32 is a liquid corrosion inhibitor for use with muriatic, phosphoric, and other liquid acids. Specifically designed to prevent corrosion on metals when added to the acids, the recommended concentration is from 2% to 3% by volume of concentrated acid. The inhibitor is claimed to give excellent corrosion protection and is designed to meet military specifications for chemical cleaning and rust removal.

Coated Work Gloves

Surety Rubber Co., Dept. MF, Carrollton, Ohio.

New, low cost, Silvertex coated work gloves with remarkable built-in toughness for longer on-the-job life, have maximum resistance to most industrial chemicals. The coating is also snag and abrasion resistant and its reflective quality helps to keep the worker's hands cool and comfortable. The coating will not crack or peel and remains pliable for the life of the glove.

The gloves are available in eight different styles including knit wrist, band top, gauntlet and safety cuff. Knit wrist and band top styles are also made with ventilated backs for maximum coolness and gauntlets are available in three sizes. All styles are of molded curved finger design and wing thumb construction for greater hand comfort and longer wear life and are produced in jumbo size.

Wet Blaster

Tobin-Arp Mfg. Co., Dept. MF, 6400 Penn Ave. South, Minneapolis 23, Minn.

Called "Liqui-Breez," Model LB-1002, the new wet blaster is designed to perform the following operations:

honing, cleaning, deburring, and blending.

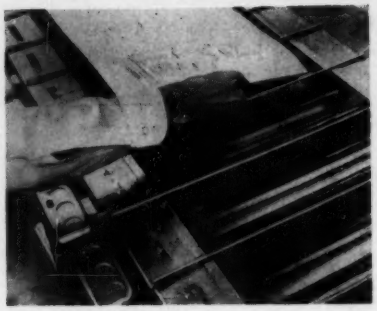
Size of the floor model is 67" high. The cabinet is 24" diameter, with a floor working area of approximately 10 sq. ft. Working area inside cabinet 380 sq. in.

Radiant Heater

Corning Glass Works, Dept. MF, Corning, N. Y.

An industrial radiant heater engineered for quick warm-up and cool-off reaches full heating capacity of 800 to 850°F within three minutes. Designed for horizontal mounting above or below the process line, the high-watt density heater produces an average of 20 watts per square inch of working surface.

The Vycor brand radiant heater



emits high efficiency long wave infrared rays from wire coils enclosed in tubes of 96% silica glass. The heat is absorbed uniformly regardless of product color. The glass tubing is highly resistant to heat, heat shock and corrosion.

A triple reflector system directs 85 to 90% of the available radiation onto the work. A strip of non-tarnishing platinum, fire-bonded to one side of the tube, literally bounces the heat toward the product. The housing, consisting of two layers of aluminized steel with Fiberglas insulation between, provides additional reflection.

Completely framed in aluminized steel, the heater comes equipped with junction box, leads, and mounting hangers. Because the units can be interlocked in parallel series and require no mid-supports, "cold spot" areas are eliminated.

The heater causes less than 10% power surge when turned on. Thus, the switches require rating no higher than that of the heater. The heater is virtually maintenance-free, according to the manufacturer. Both housing and heating element are corrosion resistant. The rigid frame won't sag in long spans. The reflector can be removed for cleaning.

Solvent Recovery System

Artisan Metal Products, Inc., Dept. MF, 73 Pond St., Waltham 54, Mass.

A new continuous solvent recovery system will reclaim chlorinated hydrocarbons, such as trichlorethylene and chlorothene, from relatively non-volatile contaminants. A very high percentage of the chlorinated hydrocarbons are reclaimed to prevent the loss of the inhibitors, which are necessary to prevent damage to the parts being cleaned. Recoveries will approach 99.9%, with a total recovery cost of less than one cent per gallon, it is claimed.

For this special application, the Continuous Evaporator Stripper was re-

designed into an economical compact package for easy installation and operation.

Acrylic Stripper

Patclin Chemical Co., Inc., Dept. MF, 11-23 Casimir Ave., Yonkers, N. Y.

A new stripper, #217, has been developed specifically to strip the difficult baked acrylic resin coatings. It can also be used to strip wrinkles, hammertones, epoxy, melamines, urea, phenol, and alkyd resins by lifting the coatings and breaking the bond existing between the basis metal and the coating. It is especially effective on difficult-to-strip, primed coatings on a phosphated base.

The stripper is used cold, full strength, in a ceramic crock or stainless steel tank. The product is non-flammable and is shipped in carboys, polyethylene and stainless steel drums.

Paint Spray Unit

The Lofstrand Co., Dept. MF, Southlawn Lane, Rockville, Md.

Known as Chemtronic, this compact, portable unit utilizes a hydrocarbon compound (Chemosene), atomized by an electronic heating element, instead of compressed air. Compared with other spraying methods now in use by American industry, the process is claimed to give high lacquer yield as well as a considerable number of technical and economic advantages, such as less spray mist and fewer health hazards in the paint shop.

Both paint and atomizing gas are heated in the unit, permitting higher concentration of solids in the material and allowing more paint to be sprayed without sagging. The atomizing gas contains no liquid. Even after a temperature drop due to expansion, paint reaches the spraying surface relatively warm. Cellulose lacquers can be spray-

NEW STOKES 72" VACUUM COATER

Shortens cycles, speeds production and provides more flexible operation

A highly versatile pumping system is the chief reason behind the increased efficiency and flexibility of Stokes new 72" Vacuum Coater. Employing a new "modular" approach to vacuum system design, the new arrangement provides greater pumping capacity and operating versatility . . . at no increase in cost. Pumping down the clean dry chamber can now be accomplished in 4½ minutes or less.

Here's how the modular system works: two separate but identical "teams" of pumps are connected independently to the vacuum chamber. In normal operation both "teams" are used. However, either team may be cut out for periodic maintenance or isolation without shutting down the entire metallizer. It's a real time and cost saver. And to make the equipment even more versatile, a third pump can be easily added.

The new "modular" approach is one more example of progress in vacuum technology at Stokes. Whether it's vacuum metallizing of decorative parts or high-precision components, Stokes experience helps lead the way to greater operating efficiencies. Why not find out how Stokes will help plan your metallizing facilities . . . select the proper equipment . . . train operators. Your nearby Stokes field engineer will be glad to discuss your particular requirements . . . and to make available the facilities of Stokes Laboratory and Advisory Services.

Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

cost cutting is fine but . . .
it's the "HOW" *and* "WHERE" *it's done*
that counts

–a message of importance from . . . DuBois Chemicals

Take paint stripping, spray booth cleaning, phosphatizing or metal cleaning. For A-1 results, you can't cut short on good, chemical ingredients.
The materials that go into DuBois cleaners and detergents are the finest. But, the application on the job requires the experience of the DuBois tech-service man. With DuBois products, he can show you that *dollar, time and labor saving* are not empty words. *Cleaning is 95% labor—5% compound costs.* When you use DuBois' program of superior compounds, combined with helpful service you save where it costs most—labor!
Our representative and tech man will show you how this is done. Write the DuBois Co., Inc., Cincinnati 3, Ohio, or call our man listed in the Yellow Pages under "Cleaning Compounds". Your metal cleaning or plant maintenance problem is probably one he has solved many times.

The DuBois Co., Inc. • General Offices • Cincinnati 3, Ohio
Plants in: Cincinnati • Los Angeles • Dallas • E. Rutherford, N. J.

Representatives and Warehouses throughout the United States, in Canada and parts of Latin America

ed in very high relative humidity without blooming, it is claimed.

Vibrating Finisher

Lord Chem. Corp., Dept. MF, 2068 South Queen St., York, Pa.

Lorco Model 1016E, a 3-hp vibrator for precision finishing, is the latest addition to a line that also includes 30-hp, 20-hp and 15-hp units. Employing controlled vibration, these machines will work from 10 to 100 times faster than tumbling barrels on jobs of cleaning, descaling, deburring, radiusing, fine finishing, coloring, burnishing and ball burnishing, it is claimed.

Of heavy-duty welded steel construction throughout, the new 3-hp vibrator has a rubber-lined bowl mounted on special coil and leaf springs. Vibratory action is achieved through the use of an eccentric shaft. The drive speed is continuously variable over a wide range, and a built-in tachometer permits direct reading of frequency. Both frequency and amplitude of vibration can be varied to fit work requirements.

An easily adjusted mechanism allows compensation for large variation in the weight of the load. Bowl is tilted by a pneumatic system controlled by a hand-operated valve. An automatically operated pneumatic oil-mist system assures proper lubrication. Electrical controls prevent the vibrator from operating without adequate lubrication.

Model 1016E is 61 in. long, 36 in. wide and 32 in. high. Shipping weight is approximately 1,500 lb. Bowl (unlined) has a capacity of 1.1 cu. ft. Frequency range (forward and reverse) is from 700 to 2,100 rpm. Motor specifications are: 3 hp, 1,750 rpm, 3 phase, 60 cycle, 208-220/440 volts.

Water-Wash Spray Booth Additive

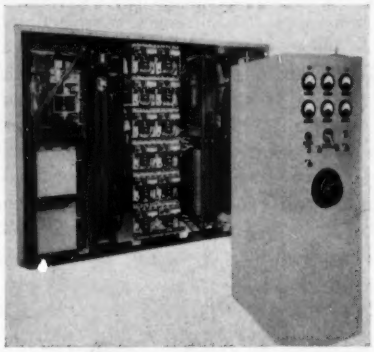
American Mogul Products Co., Dept. MF, Cleveland 13, Ohio.

Three new chemical formulas for water-wash paint spray booths, Mogul PB-550, PB-590 and PB-591, are additional formulas to supplement other paint booth compounds offered by the company in past years.

The products were designed, the company reports, to effectively control paint overspray, help to economically realize maximum production, using either standard and new paint finishes, and to help overcome other paint booth maintenance problems.

Power Supplies

Hevi-Duty Elec. Co., Dept. MF, Milwaukee, Wis.



A complete range of AC and DC industrial power supplies are designed to regulate voltage, current, or power for industrial processes.

All power supply systems are engineered and manufactured to meet customer specifications. They are factory assembled and wired with all components in a single enclosure. Control, metering, or protective systems are included and wired ready for use. All components are selected or engineered for optimum service.

Correction

The name of the manufacturer of the recent development entitled, "Automatic Controlled Rectifiers" on page 89 of the October 1959 issue should have read Djeco Division of Djordjevic Engineering Co.

BUSINESS ITEMS

Dr. Braithwaite Executive V. P. of Nalco

Nalco Chemical Co., a major producer of industrial chemicals with headquarters in Chicago, has named *Dr. David G. Braithwaite* to the new post of executive vice president in charge of manufacturing, research and development. He formerly headed the catalyst division and, most recently, has been in charge of the company's program of expansion and diversification within the chemical industry.

He has been a member of the organization since 1946, was named a vice president in 1954 and was elected to the board of directors in 1957. He holds a doctor's degree in physical chemistry from Northwestern University.

Hercules Powder Appoints Towe

The appointment of *Jerome D. Towe* as sales and technical service representative to the protective coatings industry in the Los Angeles area has been announced by *Hercules Powder Co.* The appointment became effective October 1.

Mr. Towe will represent both the Cellulose Products Department and Synthetics Department and succeeds *Cliff Skow* who is being transferred to Cellulose Products in Wilmington on a special assignment.

Mr. Towe, a graduate of Lehigh University, joined the company in 1953 after graduation, and has a background of experience in research as well as the sales and technical service of products for the paint, varnish, and lacquer industries.

Pressure Blast Buys Leiman Sand Blast Equipment Div.

The Sand Blast Equipment Div. of *Leiman Bros. Co., Inc.*, Newark, N. J., has been purchased by the *Pressure Blast Mfg. Co., Inc.*, of Manchester, Conn., it was reported. The Newark firm had manufactured sand blasting equipment since 1900 as an adjunct to its line of vacuum air pumps. The sale includes all rights, patents, tooling and inventory.

A transfer of physical inventory from Newark to Manchester has been completed and production of equipment at the new site is now underway. Distribution will be handled through current sales channels.

NO HIGHER QUALITY CAN BE DELIVERED SO CONSISTENTLY...
99.75+% PURE
BFC
Extra High Purity
CHROMIC ACID
FLAKE
BETTER FINISHES AND COATINGS, INC. NEWARK 5, N. J.
And you get prompt delivery from ample factory and nearby distributor stocks.
Next time you're in the market why not send us a modest order just to find out how good BFC Chromic Acid really is.
BETTER FINISHES & COATINGS, INC.
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BFC
PAINTS · PLASTICS · CHEMICALS

Huscher Appointed Vice President of Kaykor

Joseph L. Huscher has been appointed vice president of *Kaykor Industries, Inc.*, Division of Kaye-Tex Mfg. Corp., Yardville, N. J.

Mr. Huscher, as vice president, will be completely responsible for all operations of the company.

Berghoff Succeeds Fay At Pittsburgh Plate Glass Co.

Appointment of *Guy J. Berghoff* as vice president in charge of *Pittsburgh Plate Glass Co.'s* paint division has been announced by the company. He succeeds *C. Robert Fay* who died on July 19, 1959.

In his new position, Mr. Berghoff will be in charge of all operations of the paint division including 13 paint and plastic plants, three brush plants and one of the most modern research and development centers in the industry.

A native of Fort Wayne, Ind., Mr. Berghoff joined the company's glass advertising department in 1934. He was named director of public relations in 1944 and his responsibilities were enlarged three years later to include

Photo courtesy Hanson-VanWinkle-Munning Co.

MULTIPLE CALENDERED SHEETS
•
PERMANENT RUBBER-TO-METAL BOND
•
POSITIVE PROTECTION FROM STRAY CURRENTS

STOP CORROSION and CONTAMINATION

Where you use corrosive acids and other chemicals for pickling and metal plating be sure it's Manhattan Rubber Linings that protect your costly equipment. Thick, multiple calendered sheets of natural or synthetic rubber are bonded to tank metal so securely they can't be separated! Manhattan Rubber Linings eliminate the dangers of stray currents in plating operations. They expand and contract with metal . . . won't harden, crack or oxidize — even under extreme temperature change. To assure lifetime protection, every Manhattan rubber lined tank is tested under high voltage to detect any possible imperfections before being shipped.

Get the kind of *permanent protection* that has kept many Manhattan Rubber Lined tanks in continuous use over thirty years. Specify "Manhattan" on your equipment. Contact the Manhattan rubber lining facilities nearest you.

RM-924

RUBBER LINING PLANTS AT PASSAIC, N. J. • NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose
Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles
Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

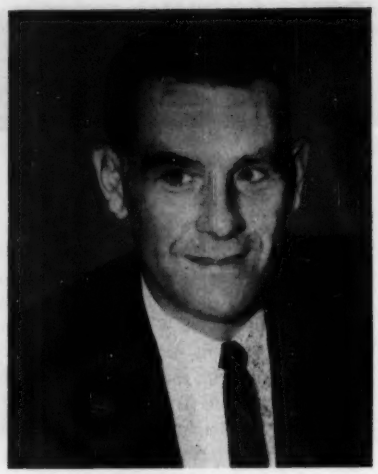
Guy J. Berghoff

direction of all of the company's advertising.

He was appointed assistant to the vice president of the merchandising division in 1954 and during the last three years has served as general manager of paint sales for the merchandising division.

New Project Engineer Appointed at Tranter

Appointment of *Stanley R. Curtis* as project engineer has been announced by *Tranter Mfg. Inc.*, Lansing, Mich. A 1949 Mechanical Engineering graduate of Michigan State University, Mr. Curtis joined the Motor Wheel Corp., Lansing, Mich., in 1950 where he was a senior project engineer and group leader in the gas heating appliance department. He also served in the insulation department and as a residential and industrial works estimator for a Lansing heating firm.



Stanley R. Curtis

Mr. Curtis is a member of the American Society of Heating, Refrigeration and Air Conditioning Engineers of which he is vice chairman of the Western Michigan Chapter.

Tamms Appoints L. H. Herr Co.

Tamms Industries Co. of Chicago have announced the appointment of *L. T. Herr Co.*, Denver, Colo. to represent its Raw Material Division in the state of Colorado, and portions of Wyoming and New Mexico.

Mr. Herr is well known to the paint industry in this territory and is a two-time president of the Colorado Paint, Varnish & Lacquer Association.

New District Sales Office for Hooker

Sales of chemicals and plastics will be facilitated over a wide area with the establishment of a new Buffalo district sales office by the Eastern Chemical and Durez Plastics Divisions of *Hooker Chemical Corp.*, Niagara Falls, N. Y.

The newly created Buffalo sales district will include New York State other than metropolitan New York City, Canadian areas near Lake Ontario, western Pennsylvania, Ohio, West Virginia, and Kentucky.

Carleton A. German Elected to Board of Directors at Solventol

Solventol Chemical Products, Inc., Detroit, announces the election of *Carleton A. German* to the board of directors.

Carleton A. German

Mr. German has been connected with the company since 1944 and was recently named general sales manager of all divisions. He had been sales manager of the Industrial Division and, prior to that, he was chief engineer.

International Rectifier Appoints Ross, Inc. Distributor

S. R. Ross, Inc., has been named authorized industrial distributor in the Salt Lake City trading area for the Distributors Sales Division of *International Rectifier Corp.*

Ross is managed by *Fenton Sharp*, and is located at 1212 State St., Salt Lake City, Utah.

Stokes to Expand Production Facilities

To cope with the growing demand for the company's steadily broadening range of products, which include many different types of high-vacuum processing equipment, pharmaceutical machinery, plastics molding equipment, and powder metal compacting presses, *F. J. Stokes Corp.*, Philadelphia, has embarked on another major expansion of its production and engineering facilities. The company has let contracts and broke ground about November 1 for a 50,000 sq. ft. addition to the present plant at 5500 Tabor Road in Northeastern Philadelphia.

This is the third major expansion in the past eight years. Additions of approximately the same size were completed in 1951 and in 1955.

The new facilities, which should be completed by the middle of 1960, will increase the company's manufacturing and assembly capacity by about 20 per cent, and will also considerably enlarge the amount of space available for product design, sales engineering, and technical service. When fully equipped, the new facilities are expected to increase employment by about 200, bringing the total number of employees over the 1,000 mark.

THE CLEANING MACHINE
THAT GROWS WITH YOU!
magnus AJA-LIF
AIR OPERATED.
MOTORLESS AND GEARLESS AUTOMATIC AGITATING AND LIFTING DEVICE. ONLY 4 MOVING PARTS.
SINGLE LEVER CONTROL FOR LOWERING, AGITATING AND RAISING THE WORK.
VARIABLE SPEED AGITATION FROM 0–160 MOTIONS PER MINUTE. ACTUALLY SHEERS THE DIRT OFF.
HEATING UNITS FOR STEAM, GAS OR ELECTRICITY.
STANDARD GRATE (OR ROLLER) PLATFORM HANDLES UP TO 450 LBS. OTHER UNITS UP TO 2000 LBS.
Batch Cleaning
De-Centralized Cleaning
Conveyorized Production-Line Cleaning

FLEXIBLY ENGINEERED to offer you the time, labor and material savings of mechanically agitated cleaning **today** and **tomorrow**, the Magnus Aja-Lif adapts to current needs — never becomes obsolete.

- COMPLETE BATCHES CLEANED MORE THOROUGHLY THAN EVER IN MINUTES.
- VERSATILITY IDEAL FOR DE-CENTRALIZED CLEANING. USE WHEREVER YOU WANT ON-THE-SPOT AUTOMATIC CLEANING EFFICIENCY.
- SIMPLE CONVEYOR CONNECTS STANDARD UNITS FOR MULTIPLE STAGE OPERATIONS. WASH, RINSE, RUST-PROOF, ETC., AUTOMATICALLY, SKIPPING STAGES WHENEVER DESIRED.

YOU OWE IT TO YOUR FUTURE to find out about the benefits which the Aja-Lif offers TODAY!

MAGNUS CHEMICAL COMPANY
11 South Avenue
Garwood, New Jersey

PLEASE SEND FULL INFORMATION ON YOUR MAGNUS AJA-LIF CLEANING MACHINES.

NAME _____
COMPANY _____
POSITION _____
ADDRESS _____
CITY _____ STATE _____

magnus
EQUIPMENT • CHEMICALS • METHODS

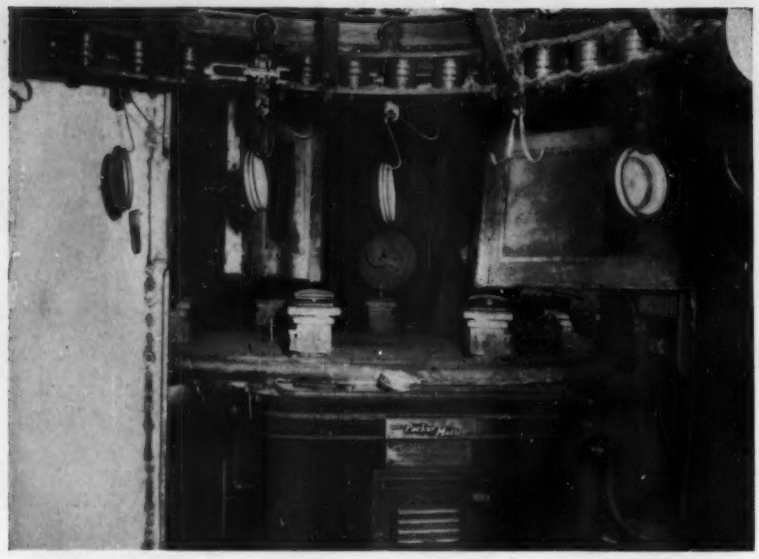
A WORLD-WIDE ORGANIZATION SPECIALIZING IN THE CLEANING AND PROTECTION OF ALL SURFACES

Roto-Finish Appoints Strom

Roto-Finish Co., Kalamazoo, Mich., recently announced the appointment of *John R. Strom* as chemist and process engineer for the company. He will be in charge of new product development, and the development of new compounds.

Strom, a Baldwin-Wallace graduate in 1951, brings considerable experience to his new post. He has served as process engineer for Brown-Lipe-Cha-

John R. Strom



24 million pot lids can't be wrong!

Ask your wife. She will tell you about famous Revere Ware. Probably best known by their copper bottoms, the durable luster of pots and pans by Revere is taken for granted.

"Taken for granted" is exactly the phrase applied to the 3 Packer-Matic polishing and buffing units in Revere's Rome, N. Y. plant by Mr. F. W. Merry, Assistant Works Manager. "We feed them and our Packer-Matics do the rest," says Mr. Merry. "They haven't failed us in 23 years of high production rate operation." "They get a good clean up twice a year and that's about the extent of our maintenance."

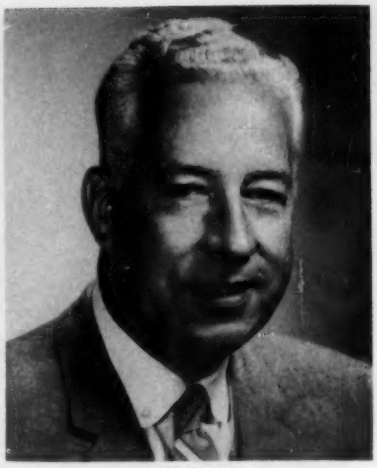
Achieving highly reflective finishes on pot lids is only one of hundreds of polishing, deburring, buffing and cleaning applications Packer-Matics have handled since Mr. Clifford I. Packer turned out his first unit in 1927. Chances are we can help you in your finishing operations, too. Send us samples with your specifications or blueprints and see.

Production reliability makes Packer-Matic the choice of companies like Revere Copper and Brass Inc.

PACKER-MATIC

THE PACKER MACHINE COMPANY • MERIDEN, CONN.

Pioneer Manufacturers of Automatic Polishing & Buffing Machines



A. W. Slocum

ments. He will now direct and coordinate the industrial finishes sales, product development, technical services and advertising programs for the corporation's six manufacturing plants.

Mr. Slocum is well known to both producers and users of chemical coatings, having a 29-year background of experience in the industry.

Pressure Blast Appoints Five New Sales Organizations

Five additional sales organizations have been recently appointed to represent the *Pressure Blast Mfg. Co., Inc.* in the sale of that company's line of blast finishing equipment:

Beesley-Hoffman Machinery Co.
Buffalo, N. Y.-Central and Western N. Y.

H. E. Hofferberth Machinery Co.
Dayton, Ohio-Central and Southern Ohio

Northern Kentucky and Eastern Indiana

Riordan Machinery Co.
Detroit, Mich.-Eastern Michigan

Stanley Supply Co.
Cleveland, Ohio-Northern Ohio

Lee Hornmeyer Co.
St. Louis, Mo.-Eastern Missouri, Southern, Illinois

Industrial Sales Service, Inc.
Dallas, Tex.-Texas, Okla., Arkansas, Louisiana, Western Missouri

Cowles Appoints Sauter

Cowles Chem. Co., Cleveland, Ohio, announces the appointment of *Robert E. Sauter* as technical sales representative in Southern Illinois and Missouri.

Sauter served with the Marine Corps and attended Regis University in Den-

pin Division of General Motors, and as plating superintendent for the Eljer Co., Marysville, Ohio.

Cooper Alloy Appoints Lewis

Cooper Alloy Corp. has announced the appointment of *Gerald Lewis* to the position of director of product engineering, to succeed *William C. Hookway, Jr.*, who resigned.

Mr. Lewis joined the corporation in 1953 as sales manager of the Vanton Pump and Equipment Division. In his new position he will be responsible for product development, design and manufacture of the company's line of stainless steel castings, valves, fittings, plastic pumps, valves and fittings.

Mr. Lewis previously was employed as chief engineer of the J. J. Ashton Co. of New York City from 1950 to 1953 and as an industrial engineer with the Conmar Zipper Co. of Newark, N. J. from 1948-1949. He received his Bachelor of Science Degree in Industrial Engineering from Columbia University in 1948.

United Wallpaper, Inc. Appoints Slocum

Arthur W. Slocum has been appointed manager of industrial finishes sales for *United Wallpaper, Inc.*, Chicago. For eight years prior to this appointment, Mr. Slocum held the position of sales manager at the Illinois Paint Works division and represented the corporation on special staff assign-

Robert E. Sauter

ver, Colorado and St. Louis University in St. Louis. His indoctrination and training program will be under the direct supervision of *Richard T. Connors,* Midwest division manager. After completion of this work he will take over his territory and will make his headquarters in St. Louis.

New Research Center of The U. S. Stoneware Co. Dedicated

Chamberlain Laboratories, the new research and development center of *The U. S. Stoneware Co.,* was formally dedicated in Stow, Ohio, September 29 as a feature of the company's centennial celebration.

Ceremonies marking the event included an "open house" at the laboratories, which gave visiting representatives of science, industry and the press an opportunity to inspect the new facilities, followed by a dinner in nearby Akron, Ohio. Principal speaker of the evening was *Dr. Foster Dee Snell,* president of Foster D. Snell, Inc., who spoke of "Research Over Nearly Four Decades." Short talks were also given by *Dr. Walter J. Murphy,* editorial director of the various American Chemical Society publications, and *Dr. Paul Bachman,* vice president and director of research of Koppers Co., Inc.

1.7 / 3.0 microns:

THERM-X-RED

IMMERSION HEATERS

Featuring

VAPO-VENT*

VAPOR and LIQUID TIGHT VENTING ASSEMBLY ON ALL QUARTZ HEATERS

and

NEO-TITE†

VAPOR and LIQUID TIGHT ASSEMBLY ON ALL METAL HEATERS

Presenting The NEW REPLACEABLE HEATING ELEMENT

THERM-X-RED, a superior line of immersion heaters, presented by N.J. THERMEX, introduces a new innovation of vapor venting to eliminate internal explosion in Quartz heaters. The VAPO-VENT assembly provides a venting system for expanding gases, a completely liquid sealed head assembly and an extremely versatile unit which permits field repair with standard replacement. These exclusive THERM-X-RED features are further aided by the NEO-TITE vapor and liquid tight assembly which protects the heating elements in both Quartz and Steel units. Here at last, is a thoroughly versatile unit permitting even accidental total immersion in highly corrosive chemicals with no harm to the equipment.

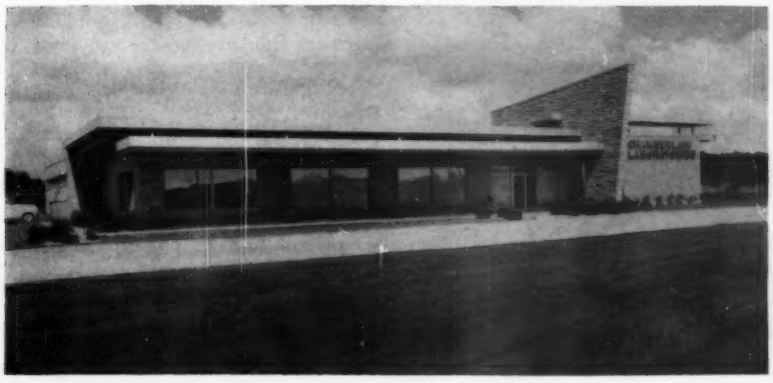
These and many more features are fully detailed in our latest catalog available on request. Models in standard, thermostatic and remote control thermostatic units are available in Steel, Stainless Steel and Quartz construction.

*ON QUARTZ HEATERS

† Trade Mark

N. J. THERMEX COMPANY, INC.

535 - 533 BERGEN ST., HARRISON, N. J.



Implementing the theme of flexibility, are the equipment and apparatus. More complete and up-to-date than that found in many laboratories vastly larger in size, it enables scientists and technicians to deal with an extremely wide range of problems. In addition, with five major universities situated within easy reach, the laboratories' location affords outstanding opportunities for mutual assistance programs with the technical departments of these universities.

President *Joan T. Wiarda* of Metals & Plastics Publications, Inc., Westwood, N. J. presented *Howard Farkas,* Vice President of U. S. Stoneware Company with the Metal Finishing, Old Timers Key.

Two Production Tests Show Wearon® BUFF CLOTH up to 48% Better than Competitive Buff Cloths

Test I Bent Copper Tubing for Sink Drain Traps 18" x 7" center—folded segment buff—8 wide folded finger

Unbleached—17,000-18,000 piece average

Wearon—26,000 pieces

Increase—48%

Test II Inside of aluminum street light reflectors—specially built machine. Wearon—31% increase in life over previous buff cloth.

Wearon, Better!! Why? Where? Under what conditions? Wearon BUFF CLOTH is better because it possesses a combination of two outstanding characteristics. The chemical treatment (1) prevents the rapid disintegration of the cotton cloth on jobs involving a high degree of raking or shearing and (2) does not stiffen the cloth. Work of various shapes can pass smoothly through buffs made of Wearon cloth allowing the buffs to mesh into and follow the contours of the object while it remains firmly anchored in the chucks.

Perhaps you would like to check Wearon's cost/performance ratio in your buffing operation? We suggest that you ask your buff supplier to prepare a test lot of buffs made with Wearon cloth in the size and design you need. In this way you can check Wearon yourself to see how it can improve your buffing performance.

Wearon is a trademarked fabric. Together with Types 160, 190 and Redline, it comprises the Milliken line of "Fabrics Engineered for Buffs".

DEERING, MILLIKEN & CO., INC.

1045 SIXTH AVENUE • NEW YORK 18, N.Y.

Ceilcote Appoints Representative

Ceilcote Company has announced the appointment of *E & M Equipment Co.* as representative in the Rocky Mountain area. An E & M sales team will develop markets for the line of industrial corrosion-proofing materials throughout Colorado, Wyoming, Montana, Utah, Arizona and New Mexico. E & M headquarters at 2415 15th Street, Denver, Colorado.

Schaffner Issues Franchise to Sterling Machine

Schaffner Mfg. Co., Inc. announces that a franchise has been issued to *Sterling Machine and Supply Co.*, 1179-15th St., S.E., Minneapolis 14, Minn.

George A. Cushman

George A. Cushman is president of the sales organization, which extends into Western Wisconsin, North and South Dakota, Iowa and Minnesota.

Acoustica Appoints DeLuca and Mehner

Frank P. DeLuca, Jr. has been appointed executive vice president of *Acoustica Associates, Inc.*, of Plainview, N. Y. and Los Angeles, Calif. Mr.

Frank P. DeLuca, Jr.

DeLuca, who is a director of the corporation, was formerly vice president and general manager of the Western Division.

Fred C. Mehner, formerly with Hughes Tool Co., has been appointed general manager of the Western Division.

Murray-Way Adds New Distributor

The *Stutz Co.* of Chicago has been appointed a Midwest distributor for products manufactured by *Murray-Way Corp.*, Birmingham, Mich. The firm, with offices at 4450 West Carroll Ave., Chicago 24, Ill., is headed by *George L.* and *Richard G. Stutz.* At present they have eight salesmen covering Illinois, Southern Wisconsin, Northern Indiana, and Eastern Iowa.

Sel-Rex Names Foulke Research Director

Dr. D. Gardner Foulke, formerly manager, electrochemical development with Hanson-Van-Winkle-Munning Co., has joined *Sel-Rex Corp.*, Nutley, N. J., as research director, Precious Metals Division. According to the announcement, Dr. Foulke will head up the firm's active research team, with the goal of developing additional

precious metals electroplating processes to produce coatings with the metallurgical properties required in exacting industrial and decorative uses.

During the more than 17 years that he has been associated with the metal finishing industry, Dr. Foulke has held technical-executive positions with such firms as Republic Steel and Houdaille-Hershey Corp. As chief chemist for the latter company, he was assigned to the

Dr. D. Gardner Foulke

Manhattan Project from its inception. He has been a teacher—Rutgers University, Beaver College, and Brooklyn Polytechnic Institute; a consultant—A. K. Graham & Associates and Foster D. Snell, Inc.; and has been active in professional societies—past executive secretary of the A.E.S. and managing editor of *Plating* magazine, vice chairman of the AES Research Committee, and vice chairman of the Electrodeposition Division of The Electrochemical Society.

Dr. Foulke holds 11 patents in the electroplating field (with four more pending), and has had 32 technical papers published by trade and professional publications.

Villwock Joins Michigan Abrasive

Richard P. Villwock, identified for years in the field of chemical and metallurgical research, has been appointed as research engineer of *Michigan Abrasive Co.*

Mr. Villwock has been engaged in research work for three well-known companies. He began his career in the Research Center of Libby-Owens-Ford in Toledo. Next came a position in the Metallurgical Research Section of Electric Auto Lite, also of Toledo. He then became associated with Midwest Abrasive Co., of Owosso, for nine years, as research director.

Richard P. Villwock

He is a member of American Chemical Society, Ohio Society of Professional Engineers and Toledo Engineering Society. He is a Registered Professional Engineer in the State of Ohio, and holds bachelor degrees in engineering and education from the University of Toledo.

Hesler Joins Nalco Chemical

James C. Hesler, 43, has joined the Ion Exchange Division staff of *Nalco Chemical Co.'s* Chicago office and laboratories, where he will handle the promotion and sales of ion exchange res-

Hammond MODERN SELF-CONTAINED GRINDER-POLISHER-DUSKOLECTOR

Reduce finishing costs — step up production with this modern, self-contained variable speed Grinder-Polisher with DusKolector. Lathe has individual, variable speed dial control for each spindle. No "down time" for one operator when the other must increase speed or change wheel. Cyclone DusKolector requires little floor space. Backstand is one of 10 Air and Spring Tension Models to choose from. Cost reduction through increased efficiency is the need of the day. Write for catalog showing America's most complete line of polishing and buffing machinery.

Hammond Machinery Builders INC.
1601 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

NEW PERFECTO-PEEN PROCESS

ONE GLASS-JET PROCESS PEENS, CLEANS, FINISHES and CUTS COSTS

Perfecto-Peening is a revolutionary new process of glass-jet peening using minute treated glass beads in a slurry solution . . . goes far beyond conventional peening. Perfecto-Peening not only cold works, stress relieves and increases fatigue life, it also cleans and improves metal surfaces down to fine finishes in its processes. Masking is never required down to and including a fine finish. No surface contamination, no imbedment, no residue. Removes flash, hinged and feather burrs, yet won't alter critical b/p dimensions even on delicate precision parts. Hundreds of peening, cleaning and finishing applications at reduced costs. Write or call us about your peening requirements and send a sample if you can.

FEATURES

- Reduces cost of peening, cleaning and finishing.
- Cold works, stress relieves and increases fatigue life . . . iron, steel, aluminum, magnesium, titanium, brass, copper, special alloys, etc.
- Cleans and improves metal surfaces down to fine finishes, no masking required to and including these finishes. No imbedment, contamination, residue.
- Improves bonding surfaces, seals pores to reduce corrosion, prepares finishes for plating.
- Removes flash, hinged and feather burrs . . . dimensional stability maintained.

MODEL A-50

Welded SS construction . . . can accommodate long parts . . . operates on 110-v 60-cycle a-c and air pressure 120 psi/50 cu. ft. minimum . . . standard connections . . . no pump required, has sump to contain glass bead slurry solution, feed system powered by an air compressor to a nozzle (gun) unit . . . write for descriptive bulletin.

Write or call us about your peening requirements and send a sample if you can.

PERFECTO-PEEN
Divn. of Aero-Test Equipment Co., Inc.
P. O. Box 10627, Dallas 7, Texas
Riverside 8-5731

ins for chemical process uses and waste treatment.

A graduate of the University of Chicago, Hesler holds a bachelor's degree in chemistry and a master's degree in organic chemistry. Prior to joining Nalco, Hesler was manager of the water and waste treatment division for Industrial Filter and Pump Mfg. Co. Previously he was employed by Infilco Inc., Tucson, Ariz., for 16 years, where he did laboratory and sales work.

Metal & Thermit Appoints Russell

The appointment of *Allen D. Russell* as organic coatings sales engineer has been announced by the Organic Coatings Division, *Metal & Thermit Corp.* He will be assigned to national accounts in the home appliance industry, and will be headquartered in Louisville, Kentucky.

Prior to his new association, Mr. Russell, a recognized authority in the vinyl industry, served as district manager for Michigan Chrome and Chem. Co., devoting much of his time to plastisol and organosol coatings.

Allen D. Russell

Mr. Russell graduated from Wayne University in 1940, majoring in Chemical Engineering. He is an active member of A.E.S.

Technic in New Location

Technic Inc., producer of precious metal solutions for electroplating, has moved to new, modern quarters at 88 Spectacle St., Cranston, R. I., telephone number STuart 1-6100.

All shipments should be made to that address, and correspondence sent to P. O. Box 965, Providence 1, R. I.

Assignments by H-VW-M

Hanson - Van Winkle - Munning Co. has announced the reassignment of three sales representatives, *Frank H. Dayton, Richard G. Marshall* and *Howard L. Wright.*

Frank H. Dayton

Richard G. Marshall

Mr. Dayton has been assigned from Dayton to the Chicago area. He joined the company in 1956, and holds a BA in chemistry from Bucknell University. He is an active member of the A.E.S. Address of the Chicago office is 6121 North Elston Ave., Chicago 46, Ill.

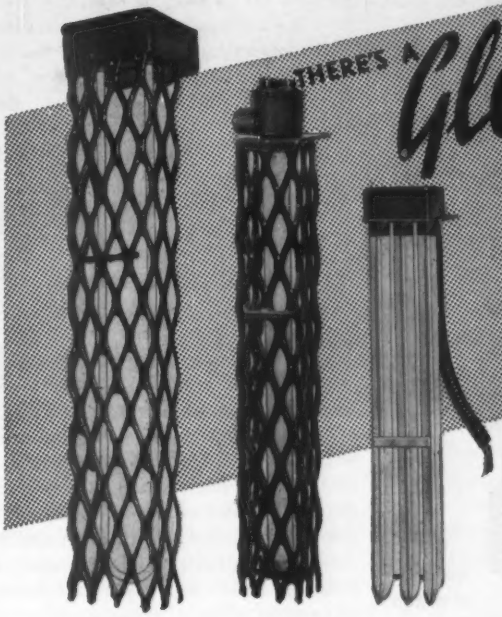
Mr. Marshall has been with the company for more than six years. A member of the A.E.S., he previously was in the plating laboratory of a nationally known industrial firm. He is a graduate of Michigan State College, B.S. in Chemistry. Mr. Marshall moves from Philadelphia to Dayton, where he will cover the western Ohio area.

Mr. Wright has been re-appointed sales representative in Philadelphia and Northeastern Pennsylvania. Thoroughly acquainted with the territory, Mr. Wright has represented the company there for 12 years. He is a graduate of Franklin and Marshall College. He served in the U. S. Navy during World War II. He will maintain his headquarters at the company's office in Philadelphia.

Howard L. Wright

The Leading Name in Immersion Heating

THERE'S A Glo-QUARTZ* IMMERSION HEATER for YOUR EVERY HEATING REQUIREMENT



All 3 Types

- INSTANT HEATING
- SHORT-PROOF
- AVAILABLE IN ALL VOLTAGES—WATTAGES, one and three phase
- STOCKED FOR IMMEDIATE SHIPMENT

TYPE "U" PATENT PENDING World's first successful U-tube **ACID** Heater—Guaranteed to outperform and outlast all other quartz heaters.

TYPE "GN" Pat. No. 2,740,881 Standard straight tube Quartz **ACID** Heater—Vapor-proof junction box; replaceable heating element.

TYPE "MB" "Multi-Blade", Metal-sheathed **ALKALI** Heater—Portable, burn-out proof, easy mounting, long life.

WRITE FOR BULLETIN

If you're looking for
ACCURACY—EFFICIENCY—LONG LIFE—and ECONOMY
...you'll get it with Glo-QUARTZ!
Available from your Electroplating Distributor!

Glo-QUARTZ ELECTRIC HEATER CO., INC.
*Trademark Reg. U.S. Pat. Off. WILLOUGHBY, OHIO Phone: Willoughby 2-5321

The Carborundum Co. Barrel Finishing Program Now in Full Swing

A fully integrated program for the manufacture and sale of abrasive tumbling media, barrel finishing compounds, tumbling machines and equipment is announced by *The Carborundum Co.*

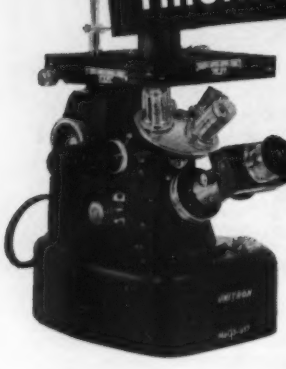
Nelson L. Watkins, industrial engineer, management consultant on metal finishing and a specialist with over 20 years' experience and scientific study on barrel finishing, is product manager of barrel finishing. Reporting directly to *D. N. Rodger*, manager of industrial sales, he will coordinate the program from engineering design through manufacturing and marketing.

Formerly president of Hydramatic Metal Finishing Inc., Cleveland, Ohio, Mr. Watkins came to Carborundum in 1958. He has collaborated with research, product engineering, and manufacturing in the development of a full line of abrasive tumbling media and barrel finishing compounds, together with the tumbling machines and equipment for their application. Under his guidance engineers and salesmen of the Bonded Abrasives and the Electro Minerals Divisions have been carefully trained in the latest barrel finishing techniques.

In addition to training salesmen and

WHY GUESS ?

MEASURE PLATING THICKNESS

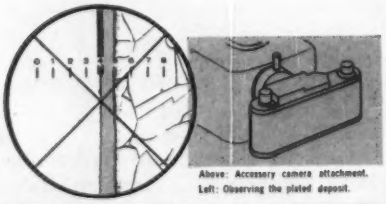


to a millionth of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to *measure and be sure*?

UNITRON'S PL-MEC PLATER'S MICROSCOPE **substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.**

UNITRON'S PLATER'S MICROSCOPE **will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a FREE 10 DAY TRIAL in your own plant. There is no cost and no obligation.**



Above: Accessory camera attachment. Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: **$540**

THE TREND IS TO UNITRON

UNITRON

INSTRUMENT DIVISION OF UNITED SCIENTIFIC CO.
204-206 MILK STREET, BOSTON 9, MASS.

Please rush UNITRON's Microscope Catalog 13-W

Name_____

Company_____

Address_____

City_____ State_____

engineers in the science of tumbling, a selected group of field sales engineers have been specially trained and stationed at the company's district sales offices throughout the United States for consultation on tumbling media, machines and methods.

Field sales engineers now in their territories are: *R. C. Bensman* services the Buffalo and Pittsburgh districts out of Niagara Falls; *John I. Jenkinson*, the New England states from West Springfield, Massachusetts; *H. S. Holman*, the New York and Philadelphia (Bristol) districts; *Joseph Laughlin, Jr.*, the Southern district out of Atlanta; *R. S. Wilson*, the Southwestern district from the St. Louis office; *E. J. Schultz*, the Detroit and Cleveland sales districts; *W. F. Quirk*, the Chicago district; and *E. J. Schweitzer* will service the Pacific coast area from the Los Angeles district office. *R. W. Fitch* and *R. A. Murphy*, product sales engineers at Niagara Falls, will give engineering support to all field representatives.

Michigan Abrasives Forms Canadian Subsidiary

A new corporation, *The Michigan Abrasive Co. of Canada, Ltd.*, located in Kingsville, Ontario, has been announced by *The Michigan Abrasive Co.* of Detroit.

Canadian sales and service activities are being supervised by *Victor R. Sanford*, resident of Kingsville, Ontario.

Gulton Names Baker To Head Executive Committee

The appointment of *Dr. W. R. G. Baker* as chairman of the executive committee of the board of directors is announced by *Gulton Industries, Inc.*

Baker, president of the Syracuse University Research Corp. and former vice president of the General Electric Co., was elected to the board of the diversified electronics firm one year ago. Joining Dr. Baker on the executive committee are *George S. Jones*, partner, Wertheim and Co., and *William G. Stott*, vice president, Morgan Guaranty Trust Co., of New York.

Associated with the original growth of the electronics industry, Baker has been past president of the Electronics Industries Association and the Institute of Radio Engineers as well as chairman of the I.R.E. professional groups.

Enthone Holds Sales Meeting

Enthone, Inc. of New Haven, Conn., subsidiary of American Smelting and Refining Co., recently held its fall sales meeting at the New Haven Motor Inn. The sales slogan for 1960, "Make Sales Soar in '60," was introduced and each sales engineer was presented with a chrome plated letter opener engraved with the slogan. Sales and technical aspects of the new products developed during the past year were discussed.

The four-day sales meeting was co-chairmanned by *W. K. Murray*, manager of marketing, and *A. Harry Sanders*, New England district sales manager.

(Seated, l. to r.) J. H. Shockcor; T. Brewer, L. H. Butcher Co.; L. J. Durney; C. C. Helmle, vice president and general manager; R. B. Goodsell; A. H. Sanders; D. S. Hartshorn; L. V. Gagnon. (Standing, l. to r.) W. K. Murray; H. M. Goldman; F. A. Schneiders; D. F. Seymour, L. H. Butcher Co.; A. R. Tefft; A. J. Kolb; E. B. Washburn; A. F. Fletcher; J. E. Rhoads; E. B. Saubestre; M. R. Herman, Vice President; J. J. Martin; J. R. Eisele. Absent when photo was taken: W. R. Meyer, Pres.

Appointments at Diamond Alkali

Three staff appointments in *Diamond Alkali Co.'s* General Sales and Market Planning Department, Cleveland, were announced recently.

John R. McCullough, field salesman headquartered at the company's Pittsburgh sales office, is named special staff assistant to the director of sales and *David F. Hahlen,* a junior engineer in the Soda Product Development group becomse an analyst in the market planning group of the general sales department — a newly-created position.

McCullough is a 20-year veteran who started with the company in Pittsburgh. In 1946 he became assistant office manager at the Philadelphia branch sales office, transferring in 1953 as a senior salesman to the Pittsburgh office. He attended Business Training College, Pittsburgh, in 1939 and then served four years in the U. S. Air Force.

Hahlen came to the organization in 1956. He is a graduate of Case Institute of Technology, Cleveland, where he earned his B.S. degree in Chemical Engineering in 1952. He served with the U. S. Army from February 1954 to February 1956.

Rex Williams, Jr. has been appointed sales service representative, his territory including the state of Alabama and the northwestern tip of Florida. He replaces *William N. Chastain* who moves on to Charlotte, N. C.

Williams joins the organization with a year and a half experience in sales work. A U. S. Army veteran, having served from December 1953 to December 1955, he attended Memphis State University in 1953 and the University of Tennessee from 1956 to 1957, majoring in industrial management.

Chastain's new territory takes in the western half of North Carolina. A graduate of Indiana University, Bloomington, Indiana, from which he earned his B.S. degree in Business Administration and Organic Chemistry in 1958, Chastain joined the organization as a sales trainee and completed the year-long program in February. He is an Air Force veteran, honorably discharged in August, 1955 after serving four years in communications.

Parker Rust Proof Executives Hold Meeting

Members of Parker Rust Proof Co.'s sales team huddled for this picture during their recent annual meeting and

45th anniversary celebration. The three day affair took place in Detroit and included a sales scrimmage on recent product developments, the anniversary banquet and a golf outing. Members of the first string are: back row, left to right: Ross Perry, Mgr. Cold Forming Division, Earl Stone, Mgr. Eastern Regional Office, Clint Rasmussen, Asst. Service Mgr., Leo Bales, Mgr., Midwest Regional Office, Ed Thompson, General Sales Mgr., Frank Hendricks, Sales Promotion Mgr., Max Roosa, Executive Vice President, Carl Moore, Mgr., South Western Regional Office, Bob Greene, Asst. Sales Mgr. Front row, left to right: Barry Dittmore, Mgr. South Central Regional Office, Van Darsey, Vice President, Mel Crandell, Asst. Mgr. Eastern Regional Office, Russ Peterson, Service Mgr., Sam Headlee, Mgr. Pacific Coast Regional Office, Harold McVey, Mgr. New Products Division.

Distributor Named by Ampco

Johnston Engineering Sales Co., P. O. Box 232, Wayland, Mass. has been appointed a distributor of *Ampco Metal, Inc.* centrifugal pumps.

Munn of Diamond Alkali Retires

Retirement of *Albert C. Munn,* veteran salesman for *Diamond Alkali Co.,* at its New York branch sales office, brings to a close nearly two decades of service to the company. He started with the firm in January 1940 as a sales serviceman in the New Jersey area.

Taking over Munn's service territory is *Girard E. Pfeil,* who has been asso-

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Cleaning and Finishing Machine

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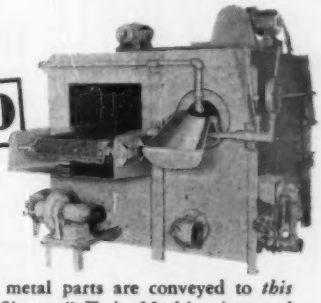

- A saving, also, in equipment cost, compared with cost of 2 separate units.
- A saving in handling, because of proximity of two units.
- Both units can be operated simultaneously or independently.
- Cleaning time in both units may be synchronized for smooth production.

Small metal parts are conveyed to *this* A-F "Siamese" Twin Machine in metal boxes covered with cutting oil. The small parts are cleaned in the rotary drum side and the metal boxes in the wire mesh conveyor side. Another example of A-F engineering to solve metal cleaning and finishing problems.

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ciated with the sales organization since September 1957. He is a U. S. Navy veteran who graduated from Bowling Green State University in 1957 with a B.S. degree in Business Administration.

Worklon Announces Two New Appointments

Worklon Inc., New York City manufacturers of acid-resistant uniforms, has announced the promotion of *Carl Robinson* from the position of sales manager to general manager, and the appointment of *Murry Menkes* as Eastern sales representative.

Mr. Robinson, who has been with the firm since it was organized in 1951, was formerly associated with S. Appel & Co. He is a graduate of CCNY, Class of 1942, and also studied at Columbia University, NYU, and at the University of Minnesota. During the war, Mr. Robinson served in both the Maritime Service and the United States Army.

Mr. Menkes, who is also an army veteran, was formerly associated with the real estate business and with the Titan Slide Fastener Co.

NEW BOOKS

Directory of New England Manufacturers

Published by George D. Hall Co., 20 Kilby St., Boston 9, Mass. 1959. Price: $45.00. 788 pages.

The 1960 edition of the directory lists manufacturers of all sizes and types throughout the six New England states. Manufacturers are listed alphabetically, geographically (first by state, then by city or town), by products manufactured and by brand names.

The alphabetical section includes company name and address, executive personnel, number of employees, products manufactured and capital rating.

The geographical section lists manufacturers first by state, then by city or town, noting beside the company name the products manufactured. (These manufacturers are located in the six state area — Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut.)

The product section lists the classifications alphabetically and under each classification the name of the company, city and state in which the manufacturer is located.

The brand name section lists the brand or trade names of the items made by the manufacturers.

Hot Organic Coatings

By Raymond B. Seymour. Published by Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. 1959. 233 pages, including index. Price: $7.50.

Beginning with a discussion of fundamentals, this book then considers the composition, properties, and applications, both of hot melt coatings and solvent-bearing materials. The fact that fluidized bed coating is included indicates the subject matter of this volume is up to the last minute.

Although some of the information appears to be elementary (such as a description of cellulose and cellulose nitrate, for example), other material, such as formulas of proprietary hot coating products and tables of physical and chemical characteristics, will be

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It's corrosion proof . . . handles all acids and alkaline solutions up to 250°. Self-priming, leakproof EPOXY sump pump provides continuous duty performance. Bracketed inside the tank, it requires no floor space. Outside bracket supports High Temp. Lucite or Epoxy filter chamber . . . ½ or ¾ HP motor. Pump and filter chambers are available separately.

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very helpful to those using hot organic coatings, who will find it a useful addition to their reference libraries.

News from California

By Fred A. Herr

Miss Marjorie Farmer, a process engineer in the Rocketdyne Division, North American Aviation, Canoga Park, Calif., reports that her summer trip to Europe was a flawlessly enjoyable one, except in one respect:

She missed connections in Paris with a fellow-member of Los Angeles Branch of the A.E.S. — *Mrs. Vonna Ott*, owner of a plating shop in Pasadena, Calif. Mr. and Mrs. Ott were also touring Europe in July and she and Miss Farmer had agreed to meet for an aperitif at a sidewalk cafe in Paris. However, they missed connections when neither remembered the hotel at which the other was to stop.

Miss Farmer's trip included visits in England, Ireland, France, Denmark, Austria, Egypt, Jordan, Lebanon, Syria and Turkey. Although she managed to get a peek or two into continental plating plants, she said she devoted herself strictly to the main purpose of the trip —vacationing.

Paul Franke, who retired in June as plating foreman for the Price-Pfister Co., Los Angeles, also was rambling around Europe about the same time Miss Farmer was there. Paul reported that he and Mrs. Franke had the pleasure of a reunion, after 36 years, with *Mrs. Mary Bausch*, a sister of Mrs. Franke. Mrs. Bausch, a citizen of Russian-controlled East Germany, was permitted to cross over into West Germany for a visit with her American relatives. She spent four weeks with the Frankes on visits. The Frankes thereafter spent five days in Paris and a short time in London before flying back, via the North Pole Route, to California. Paul's proudest souvenir of the trip is a plastic rose which he claims stoutly was presented to him by a dancer in a Montmatre cafe.

An electrically driven, continuous conveyor line on which lighting fixtures are carried through phosphating, drying, paint spraying and baking operations is included among the equipment of a new multi-purpose industrial building of 177,280 sq. ft. floor area which the Westinghouse Electric Corp. recently completed in San Lorenzo, Calif.

Referred to as the West Coast Distribution Center, the new plant is designed to warehouse appliances, lamps and lighting fixtures, as well as to provide the only facility in the Far West for assembling and finishing street, highway and floodlight equipment, and commercial and industrial fluorescent lighting units.

Unfinished lighting fixtures and parts are delivered to the California factory from production plants in Ohio and Mississippi and completed in San Lorenzo for distribution to the western market.

A new galvanizing line, making a

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total of five, recently was added to the equipment of the Colorado Fuel & Iron Corp. at Pueblo, Col., for use in production and coating of high carbon, heavy galvanized coated wire.

Larger weight and diameter coils can be handled with the new line, it is reported. Wire processed through the new line is charcoal wiped to insure uniform coating. The new line as well as one of the original set-ups, produce charcoal wiped wire, and three lines produce asbestos wiped wire.

Electronics continues as the wonderchild of the western metalworking industry, as demonstrated at the huge Wescon Show in San Francisco's Cow Palace recently, where 30,000 engineers and allied industry men viewed 900 exhibits.

Data supplied by show officials indicated that electronics in the eleven western states is at present a $1.9 billion annual business; that the West has 18% of all electronic firms operating in the United States, but does 23% of the industry's sales and employs 19% of the total personnel.

The show revealed that, in the past ten years, the electronics industry in the eleven western states has grown from 85 firms with 11,000 employees (1949) to 770 firms employing 146,000 (1959), with sales approximating two billion dollars. Area-wise, Southern California claims 461 electronic firms employing 84,000; northern California has 144 companies with 40,000 employes. The San Diego area is credited with 31 firms, Phoenix-Tucson 21, Denver 18, and Portland-Seattle 35.

No breakdown is available to indicate the tremendous part plating plays in the western electronics industry, although it is known that numerous printed circuitry, precious metal plating, and other plating operations devote their whole or part-time operations to this type of work in California.

S. S. Carlson, sales manager, Circo Equip. Co., Rahway, N. J., manufacturers of degreasing equipment, was in California on a business trip in August.

Another visitor from the East Coast was *Paul Kirchartz,* president, Metal Finishing, Inc., Newark, N. J., manufacturers of deburring units.

Both Carlson and Kirchartz held conferences with Alert Supply Co. executives in Los Angeles and San Francisco, which firm serves as West Coast distributor for Circo, and for the Honite Division, Minnesota Mining & Mfg. Co.

Pioneer Plastics Corp. has leased a new 65,000 sq. ft. building in the Pico-Rivera area of Los Angeles County for the manufacture of plastics products for the building and other industries. Located on Paramount Blvd., and Trojan Street, the new facilities involve a consideration for land, building, and lease of approximately $1,750,000.

F. K. Vaughan has been appointed supervisor of metal finishing, heat treating, spot welding, and casting for the research and development service division of Hughes Aircraft Co. at Culver City, Calif.

The American Society for Testing Materials convened for its Third Annual Pacific Area meeting at the Sheraton-Palace Hotel in San Francisco, October 11 to 16, with a broad pro-

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gram consisting of 53 technical sessions, five industry luncheons, an exhibit of instruments and apparatus, and field trips to laboratories and industrial plants.

A wide variety of symposiums and forum discussions were presented. Of interest to members of the metals and plastics industries were the discussions on Ceramics in Nuclear Energy, Non-Destructive Testing in the Missile Industry, Reinforced Plastics, Materials in the Electronics Industry, The Newer Metals, and Utilization of Water and Industrial Waste Water. The large number of conferences and symposiums made it necessary to hold meetings in half a dozen downtown hotels and in the auditorium of the Pacific Gas & Electric Co.

A National Aeronautic Conference, held under the auspices of the SAE at the Ambassador Hotel, Los Angeles, October 5 to 9, drew an attendance of 2500 aeronautical engineers and executives.

The sessions on October 5 and 6 were devoted to production-engineering topics; and on October 7 and 9 to design-engineering subjects and airline topics. Presented were 57 papers (4 rated as classified) and 16 panel discussions.

One-hundred firms sponsored booths in the SAE Missile and Aircraft Engineering Display which was held in conjunction with the conference.

Coast Pro-Seal Mfg. Co. has completed a new $500,000 chemical division production facility in the Rancho San Pedro Industrial District near Long Beach, Calif.

Located at 19240 Reyes Avenue, the new plant contains 42,000 sq. ft. of floor area. It is to be used for manufacturing coatings, sealants and adhesives for the aircraft, electronic, and marine industries. The facilities include manufacturing, office, and laboratory areas. Office, laboratory, and quality control room reportedly are completely air conditioned with special attention given to a constant temperature room within the quality control area. The heating and cooling systems designed for the manufacturing process will use a new mineral oil heat transfer principle.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Los Angeles Committee Completing Convention Plans

Tony Stabile, General Chairman of the 47th annual convention of the American Electroplaters' Society to be held at the Hotel Statler in Los Angeles July 24th to 28th, 1960, announces that the plans for this meeting are nearing completion.

The technical program, which will include nine sessions and 37 papers, has been tentatively approved. *Earl W. Arnold*, associated with the L. H. Butcher Co., is chairman of the Educational Sessions.

Probably no city in the country offers more in the way of outside pleasure and amusement than greater Los Angeles. The Ladies Program will include a luncheon at the new Beverly Hilton Hotel, an all-day outing to Dis-

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neyland located about 40 miles from the city, a tour of the Beverly Hills residential area where movie stars live, and other activities.

Headquarters for the convention will be at the Statler Hilton Hotel located on the edge of the downtown business district, and large enough to accommodate all. *Norman E. Painter*, c/o Hall-Mak Company, 1380 W. Washington Blvd., Los Angeles 7, California, is in charge of housing.

The General Chairman, Tony Stabile, is associated with the Associated Plating Co., 417 E. 16th Street, Los Angeles 15, California, RIchmond 9-3135. *George J. Hetz*, his assistant, is with C & W Metal Finishing, Inc., 3525 S. Greenwood Ave., Los Angeles, California, PArkview 2-3220.

Los Angeles has 375 job plating shops, more than any other city in the United States or in the world and new ones are being established. It is estimated that 600 new persons move into Los Angeles every day.

Blue Ridge Branch

The branch held its first meeting of the new season on Sept. 11, at the Blue-View Restaurant in Mount Airy, N. C.; with 31 members and guests present, and *Dr. Nelson F. Murphy* presiding. Attendance included those from Durham, Roanoke, Greensboro, and Blacksburg. A new publication to be known as "The Branch News" was given official recognition and authority. It will be edited by the branch secretary.

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After a brief hashing of branch business, the meeting was turned over to *William J. Miller, Jr.*, of Proctor Electric Co. Mr. Miller introduced the officers of this booming Mt. Airy plant and conducted the group through a full plant tour. This was the third plant tour in recent months.

Robert H. Probert,
Secretary/Treasurer

Waterbury Branch

The branch had its first meeting of the current season on Tuesday, Sept. 10, at the Roger Smith Elton Hotel. President *Frank Tirendi* called the meeting to order at 8:00 p.m. The chairman of the nominating committee, *Ted Voyda*, brought in the slate of delegates and alternates for the National Convention. The nominations for delegates were *Perry Sloane, Frank Tirendi*, and *William Giesker*. The nominations for alternate delegates were, *William Innes, Earl Couch* and *Frank Schneiders*. Elections will be held at the October meeting.

Technical Chairman *Spencer Henn* introduced the speaker, *Charles Wyckoff*, whose topic "Stop Them Before They Start" was of particular interest to the members present. He discussed the cause and effects of fires in industries both by lecture and by the showing of a film which pictured many of the hazards of which we are unaware. The discussion lasted late into the evening.

Francis A. Schneiders,
Publicity

Platers to Meet in Miami

M. H. Dent, Plating Superintendent at Pan American World Airways in Miami, announces that plans are nearing completion for the second annual Dixie Regional Educational Session of the American Electroplaters' Society. This meeting will be held on January 15 and 16 at the Saxony Hotel on the ocean front in Miami Beach. It will feature a two day technical session and a cocktail party and banquet on the 16th.

A ladies program is planned, and for the men a tour of the engine overhaul and repair facilities of National Airlines.

M. H. Dent

For further information, write or phone M. H. Dent, 4798 N.W. 5th St., Miami 44, Florida, HIghland 6-9664.

Columbus Branch

The regular meeting on Sept. 11 was called to order by President *Marvin Pingel*, with forty members and guests present. The minutes of the May meeting were read and approved. Three

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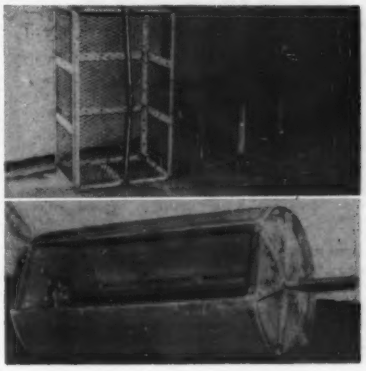

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candidates were duly approved and elected to membership. In the business meeting which followed it was ruled that President Pingel would select a committee to consider nominations for Technical Man of the Year.

Librarian *Hugh Miller* introduced the speaker of the evening, *James J. Shyne*, of Reaction Motors, who spoke on "Electrophoretic Coatings." Mr. Shyne gave an interesting account of the theory and practice of the electrophoretic method of applying metal, metal oxide, and cement coatings to basis metals. He also described post-treatments including reduction and densification. A lively question period followed. Mr. Shyne also presented a fascinating film and commentary on Reaction Motors jet motor program which has provided the half-million horsepower motor for the X-15.

The meeting was adjourned and refreshments were served through the courtesy of The Globe Chemical Co.

L. D. McGraw,
Secretary

Chicago Branch

The September 11 meeting was held at Stella's Restaurant, 3206 N. Kostner Ave. in Chicago. An overflow crowd attended the dinner and first technical session of the new year. *Ed Smith* reminded the members of the "Golf-Outing" at the Itasca Country Club on Friday, Sept. 25. *Paul Glab* announced that there will be an exhibit and educational session held at Rockford College in Rockford, Ill., sponsored by the Midwest Regional Society Group. Every member should try to attend this noteworthy event on Saturday, Nov. 7.

Joan Trumbour Wiarda, president of Metals and Plastics Publications, Inc., Westwood, N. J., presented *Rudy Hazucha* of The Clinton Co. with the Metal Finishing "Old-Timers Key." Rudy accepted the gold plated key with a great deal of sentiment and thanks. He has attended every meeting of the branch since becoming a member in August 1915. He also has an unbroken record at the annual AES Convention, having attended his 44th in June of this year.

Three membership applications were turned over to the board of managers.

Simon Gary, librarian, introduced the speakers and the subject was "This One Turned My Hair Gray." The speakers were *R. Johnson*, Metal and Thermit; *D. Saporta*, Udylite Corp.; *L. Shustick*, Du Pont; *P. Stevens*, Sel-Rex; *E. Wild*, R. O. Hull; and *D. Norris*, Hanson - Van Winkle - Munning. These service men are well known to the Chicago Branch. Mr. Johnson told how a chromium tank became contaminated because platers were skipping the rinses with work coming from the nickel tank. Mr. Norris had a problem of a silver tank going bad after the lunch hour. He found that a worker was using the tank to clean out his soldering cup. Mr. Shustik related how a copper tank became contaminated with lead because the filter was lined with lead. Mr. Wild was confronted with a problem of cadmium turning brown upon storage during the hot, summer months. Air drying the parts after brite dipping in the nitric dip and replacing the nitric acid with a bright chromate dip helped to solve the problem. After a question and answer period the speakers were given a rising note of thanks.

Christopher Marzano,
Publicity Chairman

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Blue Ridge Branch

The branch met on Oct. 2nd at the Carlton Terrace Hotel in Roanoke, Va., *Dr. Nelson F. Murphy* presiding. Delegates for the 1959-60 term were announced as *T. R. Boggess, Bruce Wallace, Dr. Nelson F. Murphy;* and alternates as *L. C. Jackson, H. R. Welfare,* and *Michael Milo.* The new membership of *Donald H. McGee* of Bassick-Sack in Winston-Salem, N. C., was announced.

The 3rd Annual Dixie Regional Technical Session will be held February 3 & 4, 1961, at the Hotel Roanoke, in Roanoke.

The speaker for the evening was *W. A. Helbig,* Marketing Division, Atlas Powder Co., who talked on "Purification of Plating Solutions by Activated Carbon Treatment."

Robert H. Probert,
Secretary

New York Branch

The annual Educational Session will be held on Saturday, February 6, 1960, at the Statler-Hilton Hotel. While the men attend the technical session, there will be a bingo party, with many gifts, for the ladies. Both affairs will start at 2:00 p.m.

At 7:00 p.m. the dinner-dance will be held in the Terrace Ballroom. The committee is now getting together the entertainment program. Additional information will be given in a future issue.

Rochester Branch

The first meeting of the 1959-60 season was held at the German Club on Monday, Sept. 14. A smorgasbord, attended by 31 members and guests, preceded the business meeting, which was called to order by President *Anthony J. Cottrone.*

Highlights of the meeting were:

1. The generous acceptance by the Rochester area suppliers' representatives to sponsor individually the refreshments following each monthly meeting.

2. *Frank Beuckman* presented the details of the proposed Metals Engineering Institute Course on Electroplating by *Dr. William Blum* to be given jointly to members of the Rochester Branch of the A.E.S. and members of the A.S.M. The proposed venture was received with a considerable degree of enthusiasm by those present.

3. An invitation was extended by the Syracuse Branch to the members of the Empire State group to attend their meeting at the Geneva Country Club on September 21.

4. Announcement was made of a bowling party to be held for members and their wives on October 10.

Barrie M. Gardner,
Secretary

Phoenix Branch

All present were urged to cooperate to make the installation meeting, to be held at the Valley Ho, Scottsdale, Ariz., Friday, Oct. 9, a hugh success.

Robert Hays was appointed sergeant-at-arms. Committee chairmen were announced:

Floyd Huhn — Membership
Paul Wible — Publications
Dean Hill — Publicity
Robert Axsom — Programs
Paul Madden — By Laws

James Weaver read an invitation from *Myron Browning,* president of

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the Dallas-Ft. Worth Branch, to attend the Aerospace Finishing Symposium to be held December 7, 8, and 9, 1959.

Paul Wible, librarian, announced the list of speakers for this year and introduced the speaker, *Gene Bosl*, of Hanson-Van Winkle-Munning Co. Gene gave an entertaining and informative talk on "Practical Nickel Plating." Particularly, his discourse on sulfamate nickel was welcomed by the audience.

The meeting adjourned at 10:00 p.m.

James E. Weaver,
Secretary

Detroit Branch

The fall season got off to a rousing start on Friday, Sept. 11th, with more than 200 members gathered in the Wayne Room of the Statler-Hilton Hotel to hear *W. E. Lovell* speak on the timely subject of "Dual Chrome Plating of Cold Rolled Steel for Automotive Hardware." Mr. Lovell discussed the theory of the corrosion resistance of the process, illustrating his interesting dissertation with a series of slide films. Immediately prior to the general meeting, the regular monthly meeting of the branch executive group and committee chairmen was held. This meeting was presided over by *Donald M. Bigge.*

The next meeting was held on Tuesday, Oct. 6th instead of the normal meeting date of Friday, Oct. 2nd. This was a joint meeting with the Society of Die Casting Engineers, Inc., Detroit-Saginaw Valley Chapter.

The speaker was *W. H. Safranek* of Battelle Memorial Institute, Columbus, Ohio. His subject was "Factors Affecting Quality of Electro-Plated Zinc Die Castings."

William Anderson

Buffalo Branch

The branch held its first meeting of the 1959-60 season Friday, Sept. 11th, at the Niagara Manor in Buffalo, N. Y. with 33 members and 6 guests in attendance. *George Wolf, Charles Church, Nelson Hornung* and *Ray Johnson* were elected to membership. *Bert Kirchoff* reported on happenings at the business session of the Golden Jubilee Convention. Mr. Wolf and *Bob Eich* were appointed as delegates to the Technical Societies' Council of the Niagara Frontier. The committee for the annual Christmas Party is *Roger Brown*, chairman, *Fred Goeckel* and *Dick Piccoli.*

After the business session Mr. Kirchoff introduced the speaker of the evening, *G. A. Lux* of Oakite Products, Inc. whose subject was "Some Fundamentals of Metal Cleaning." The talk was supplemented by several interesting demonstrations of basic cleaning applications.

The Christmas Party will be held in place of the regular meeting in December. Details to be announced later. The January meeting will be held Friday, Jan. 8. *C. H. Sample* of The International Nickel Co. will talk on "Corrosion Behavior and Protection Value of Electrodeposited Coatings."

Robert E. Lienert,
Secretary

Indianapolis Branch

The Branch started off the 1959-60 season with much interest and enthusiasm on Tuesday, Sept. 1st, at the "Construction League," 1436 N. Delaware St. with 42 present for the dinner and 53 present for the meeting. *Phillip J. Clough*, National Research Corporation, spoke on "Vacuum Metalizing for Corrosion Protection." He described preparation of various surfaces for the finish, coating on plastics compared with other finishes, and costs. Many slides were shown during the talk and several questions were asked at the end by members.

The business meeting was called to order by the new president, *Les Reynolds.* First order of business was the presentation of a past-president's pin to *John Hood*, last year's president. *Ed Bruck* was asked by the president to make this presentation. The president appointed *Quentin Shockley* as parliamentarian for the meetings.

Explanation followed about the per capita tax by *John Holland.* A motion was passed to increase the Indianapolis Branch dues to $11.00. It was recommended that the branch pay the additional $1.80 for this year rather than tax each individual.

One application for membership was read, for *Robert W. Buck*, 4442 Southern Dr., Anderson, Ind. As the branch intends to follow the national by-laws, future membership applications will be investigated for 30 days before voting.

The meeting adjourned at 10:00 P.M.

Edna Rohrabaugh,
Secretary

Los Angeles Branch

The branch opened its fall series of meetings with a timely educational program in the form of a panel discussion in which the applications and advantages of electroless nickel were presented by three Southern California authorities in that field of metal processing.

As panelists, Librarian *Miss Marjorie Farmer* introduced the following: *Willard Bell* of Chem-Research Co., *Martin Yardly* of the Chem-Nickel Co.,

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and *Bert Sherwood* of the Chem-Plate Co.

Miss Farmer explained that the program was arranged in response to requests from a number of members who felt that group discussions at the monthly meetings offered a more instructive form of educational program than a talk by a single speaker, in that the aspects of a subject of current interest to processors, consumers, and customers could be thrashed out in give-and-take discussion between the panelists and the members on the floor.

The September 9 program was presented in two parts; First a 12 minute talk by each of the three panelists on an assigned phase of the general subject; and (2) open forum discussion during which Sherwood, Bell and Yardley answered questions shot at them by the members, with Miss Farmer serving as moderator.

The first fall meeting drew an attendance of 85 members and guests. First Vice-president *Frank Virgil* presided in the absence of vacationing president *George J. Hetz.*

Tony Stabile, the 1960 National Convention Chairman, reported that the recent death of *Marty Barsoon* made a change in the convention committee personnel necessary. He reported that *Norman Painter* of the Hall-Mak Co., Los Angeles, has been named chairman of the Convention Housing Committee to replace Barsoon.

Don E. Baudrand reported that the handbook which Los Angeles branch is preparing for distribution at the 1960 convention is nearing the stage when the material can be turned over to the printer. The volume will contain a wealth of technical articles on plating subjects and a membership roster. It is intended for distribution to convention visitors, to branch members, and non-member shop owners.

A report on developments at the Detroit convention was presented by Delegate *Norman McEwan.* He called attention to the fact that delegates for the 1960 convention must be elected earlier than in previous years. As a result Chairman Virgil announced that election of 1960 delegates will take place at the October 14 meeting.

New members initiated on September 10 were *Charles R. Shoenman, Eugene Beck* and *H. R. Morrison.* Five applications for membership were turned over to the appropriate committee for processing. September meeting visitors included *F. K. Vaughan* and *Robert Yackey* of Hughes Aircraft Co., Culver City; *Charles Williams,* Mefford Chemical Co.; *E. D. Johnson,* Rome Cable Co.; *R. R. Parsons,* Chem Research Co.; *M. W. Miranti,* Harvey Aluminum Co.; and *S. H. Coleman* and *D. W. Polter* of General American Transportation Co.

New York and Newark Branches

The joint regional meeting between the New York and Newark branches was called to order on September 25, 1959, at the Statler Skytop by New York branch president *Joseph Rembecki.* The audience was a large one and included, among may notables in the electroplating field, *Dr. Andrew Wesley,* who is 2nd vice-president of the National A.E.S.

Presentation of the first Louis Donroe Award for the best "Timely Topic" of the past year in Newark was made by *Mrs. Louis Donroe.* The award consisted of a plaque and $25.00 in cash, and was given to *James Shyne* for his talk on "Electrophoresis."

Chairman *Martin Pollack* then announced the two speakers of the evening, *Dr. Edward Saubestre* of Enthone, who discussed "Metal Cleaning" and *Gus Mendizza* of Bell Telephone Laboratories, who spoke on "Plated Coatings for Electrical Contact".

In his talk, Dr. Saubestre indicated that numerous methods for evaluating the cleaning process are available and each has its own particular area of usefulness. Although the oldest method of determining how clean a material is after it has been immersed in a liquid is to observe the water breaks, if any, in the laboratory, such a test can only be used for rough qualitative results. Modification of this procedure, such as the atomizer test and other more exacting though frequently involved tests such as fluorescent dyes and gravimetric analyses, are more useful in laboratory evaluation of cleaning materials and the cleaning process.

Dr. Saubestre further indicated in his talk that methods such as the atomizer test may reveal the capabilities of a particular cleaner when used on given shop dirt even though the test be conducted on the required standard panel and not, say, on an aluminum casting. Graphs were shown which indicate that cleaning is a straight line function of time and temperature, increasing with both.

The second talk of the evening was presented by Gus Mendizza, who not only had excellent material, but also presented it well. His topic, "Plated Coatings for Electrical Contacts" dealt with investigations made at the Bell

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Telephone Laboratories to find out which metal coatings are best for all-around electrical contact purposes. The parameters of the study were cost, contact resistance, corrosion resistance, solderability and reproductibility both a short time after electroplating as well as long after they have been placed in service under field conditions. Though the studies were primarily aimed at low voltage electrical contacts, it is reasonable to assume that much of the data obtained in his tests apply equally well for higher voltage applications.

Mr. Mendizza indicated that commercially pure (99% plus) gold in thicknesses of 0.0002" or more proved to be the best with regard to the testing methods. He also indicated that the thickness is so high only because the porosity in commercial practice is relatively high and the porosity itself (or lack of it) is the major factor to consider, rather than thickness per se.

The large audience present showed considerable interest in both talks by directly mentioning it to the speakers and by the nature of the questions presented to the latter.

NAMF Committee Chairmen Named

Key committee leadership posts were filled recently by *A. T. Leonard* of Superior Plating, Inc., Minneapolis, president of the National Association of Metal Finishers.

Appointments included: membership-public relations, *Robert L. Giesel*, Adolph Plating, Inc., Chicago; educational, *Edward N. Marlette*, Marlette Plating Co., Buffalo; constitution and by-laws, *James E. Cogan, Jr.*, Globe Electroplating Co., Philadelphia; ethical and standard practices, *John T. Hyduke*, Durable Plating Co., Cleveland; standards and specifications, *Henry A. Kajarski*, Chemical Processing, Inc., Detroit; industrial liaison, *Charles R. Leva*, Levco Metal Finishers, Inc., Long Island, and *John Palik, Jr.*, National Plating Corp., Cleveland; liaison, American Electroplaters' Society, *James E. Cogan, Jr.*; and liaison, Metal Finishing Suppliers' Association, *Harold W. Baker*, Electro-Galvanizing Co., Chicago.

An ambitious program is planned for the months ahead by committee chairmen, including the release of industry operating cost data, management manual, industry ethics and standard practices, standards and specifications and a dynamic membership promotion and public relations program.

The National Association of Metal Finishers, with headquarters in Cedar Grove, N. J., comprises, in the main, owners and operators of metal finishing contract firms. Fourteen affiliated groups are located in the United States and Canada.

Manufacturers' Literature

Wetting Agent

MacDermid Inc., Dept. MF, Waterbury, Conn.

Macro-Wet 1, a concentrated liquid wetting agent particularly intended for use in strong oxidizing (chromic and nitric acid) solutions is fully described in Technical Data Sheet No. 94, a usage and instruction sheet.

Belt Polishers

Murray-Way Corp., Dept. MF, P. O. Box 180, Birmingham, Mich.

A new 8½ x 11, illustrated, eight page, two color brochure (Form 59-1) discusses features and advantages of Micro-Polish units and gives detailed engineering specifications. Photographs and descriptions of auxiliary equipment and the many variations and combinations are also included.

Self-Cleaning Pipeline Strainer

Sarco Co., Inc., Dept. MF, 635 Madison Ave., New York 22, N. Y.

Bulletin 1210-1, just released, describes a brand-new addition to line of self-cleaning pipeline strainers in sizes from ¼" through 3".

Abrasive Wheels

The Carborundum Co., Dept. MF, Niagara Falls, N. Y.

Over 1600 experience-tested abrasive wheel recommendations are set up in alphabetical order in this new 57 page, three-hole punched specifications catalog. Material, work, operation, with their respective recommendations on abrasive, grit, grade and bond, are listed for quick reliable reference.

Plating on Aluminum

MacDermid, Inc., Dept. MF, Waterbury, Conn.

The Alumetex process for preparing commercially used aluminum alloys for any type of electrodeposit is fully described in Technical Data Sheet No. 13, a new five-page usage and instruction sheet.

Abrasive Finishing of Aluminum and Magnesium

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

A new data sheet covers the abrasive finishing of aluminum and magnesium and their alloys. Complete data on wheel heading, lubrication, speed and

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type of buff are included. The sheet covers such finishes as satin, mat, butler and bright. Instructions are applicable to such forms as castings, formings, extrusions, spinnings and stampings.

Plastic Products

Kaykor Industries, Inc., Dept. MF, Yardville, N. J.

A new catalog describes Rigid PVC products, their properties and applications.

Ultrasonic Cleaning

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington, N. J.

A free 12-page ultrasonic cleaning primer is designed to provide a clearer understanding of what ultrasonic cleaning is, how it works, areas in which it can be employed and various solvents and detergents available for use with this kind of equipment.

Barrel Finishing

The Carborundum Co., Dept. MF, Niagara Falls, N. Y.

A seven-point system for scientifically controlled barrel finishing is detailed in a 36-page, multi-colored booklet which sets forth size and type of media; ratio of media to parts; load height; water; compounds; barrel speed; and tumbling time. A complete line of tumbling media, barrel finishing compounds and precision barrel finishing machines and equipment is listed for the full range of tumbling operations.

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Chemical Products

Hooker Chem. Corp., Dept. MF, Box 344, Niagara Falls, N. Y.

A newly revised products list, bulletin No. 100-C, contains brief descriptions, physical data, uses, and shipping information with respect to the many chemicals listed. Chemicals manufactured by the firm's Phosphorus Division are separately listed and described in a new two-page supplement which is also available.

Electric Indicators and Controllers

General Electric Co., Dept. MF, Schenectady 5, N. Y.

Bulletin GEZ-2898 (10 pages) describes d-c millivoltmeter and bridge-type controllers, temperature scanner systems, and saturable reactor control systems for indication and control of temperature and other variables. It includes discussion of typical measurement applications, principles of operation, control forms, and specifications and scale ranges available.

Chemical Polish for Aluminum

MacDermid Inc., Dept. MF, Waterbury, Conn.

Metex Electropolish BA, an acidic solution for producing bright luster on non-silicon aluminum alloys is fully described in Technical Data Sheet No. 55, a two-page usage and instruction sheet.

Vibratory Finisher

Lord Chem. Corp., Dept. MF, 2068 S. Queen St., York, Pa.

Four-page, letterhead-size bulletin No. 1930E describes the new 15-hp "Lorco Vibrator," which employs controlled vibration for precision finishing of an exceptionally wide range of types, shapes and sizes. Detailed specifications are given as well as construction features, standard equipment and general information.

Abrasive Blasting

Pangborn Corp., Dept. MF, Hagerstown, Md.

Bulletin No. 609 describes the complete line of Rotoblast descaling machines. Photos, diagrams, cut-aways and sketches show details and operating features of the wheels which provide the cleaning force, and various cabinet designs and material handling features appropriate to the type of work being descaled are described.

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11-13 43rd Rd., Long Island City 1, N. Y.
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Alert Supply Co. 113
2041 S. Davie Ave., Los Angeles, Calif.
Allied Chemical Corp., Solvay Process Div. 29
61 Broadway, New York 6, N. Y.
Allied Research Products, Inc. 30
4004 E. Monument St., Baltimore 5, Md.
Alvey-Ferguson Co., The 111
504 Disney St., Cincinnati 9, Ohio
American Brass Co. 26
Waterbury 20, Conn.
American Buff Co. 115
2414 S. LaSalle St., Chicago 16, Ill.
American Metal Climax, Inc. 37
61 Broadway, New York 6, N. Y.
Apothecaries Hall Co., Div. of The Hubbard-Hall Chemical Co. 32
22 Benedict St., Waterbury 20, Conn.
Armitage & Co., John L.
245 Thomas St., Newark 5, N. J.
Atlantic Compound Co. 95
6 Charles St., Chelsea 50, Mass.
Bacon Felt Co.
437 W. Water St., Taunton, Mass.
Baker Bros., Inc. 126
Turnpike St., Route 138, Canton, Mass.
Baker Co., Alan 127
180 Sylvester Rd., South San Francisco, Calif.
Baker Co., The M. E. 124
25 Wheeler St., Cambridge 38, Mass.
Beam-Knodel Co. 118
195 Lafayette St., New York 12, N. Y.
Belke Manufacturing Co. 11
947 N. Cicero Ave., Chicago 51, Ill.
Better Finishes & Coatings, Inc. 101
268 Doremus Ave., Newark 5, N. J.
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571 Webster Ave., New Rochelle, N. Y.
Carbone Corp., The
Boonton, N. J.
Carborundum Co., The 8, 9
Niagara Falls, N. Y.
Chemical Corp., The 97
58 Waltham Ave., Springfield 9, Mass.
Churchill Co., Inc., Geo. R. 34
Hingham, Mass.
Clair Manufacturing Co., Inc. 41
Olean, N. Y.
Cleveland Process Co.
1965 E. 57th St., Cleveland 3, Ohio
Clinton Supply Co. 125
112 S. Clinton St., Chicago 6, Ill.
Cohn Mfg. Co., Inc., Sigmund 46
121 S. Columbus Ave., Mt. Vernon, N. Y.
Colorward Corp.
4515 Superior Ave., Cleveland 3, Ohio
Columbia-Southern Chemical Corp. 42, 43
One Gateway Center, Pittsburgh 22, Pa.
Conversion Chemical Corp.
100 E. Main St., Rockville, Conn.
Crown Rheostat & Supply Co. 18
1965 Pratt Blvd., Elk Grove Village, Ill.
Davies Supply & Mfg. Co.
4160 Meramec St., St. Louis 16, Mo.
Davis-K Products Co.
135 W. 29th St., New York 1, N. Y.
Deering, Millikan & Co., Inc. 106
1045 Sixth Ave., New York 18, N. Y.
DeVilbiss Co., The 50, 51
Toledo 1, Ohio
Diversey Corp., The 17
1820 Roscoe, Chicago, Ill.
Dixon & Rippel, Inc.
Box 116, Saugerties, N. Y.
Djeco Div., Djordjevic Engineering Co. 118
1933 N. Damen, Chicago 47, Ill.
Dow Chemical Co., The 54, 55, 56
Midland, Mich.
DuBois Co., Inc., The 100
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Du-Lite Chemical Corp.
6 River Rd., Middletown, Conn.
Du Pont de Nemours & Co., E. I. 47
Wilmington 98, Del.
Dytex Chemical Co. 48
140 India St., Providence 3, R. I.
Electro-Glo Co. 116
621 S. Kolmar Ave., Chicago 24, Ill.
Engelhard Industries, Inc., Chemical Div. 16
113 Astor St., Newark 2, N. J.
Enthone, Inc. 3
442 Elm St., New Haven 11, Conn.
Erie Engine & Mfg. Co.
953 E. 12th St., Erie, Pa.
Federated Metals Div., American Smelting & Refining Co. 23
120 Broadway, New York 5, N. Y.
Formax Mfg. Co. 112
3171 Bellevue, Detroit 7, Mich.
Frank, Paul 123
118 E. 28th St., New York 16, N. Y.
G. S. Equipment Co. 49
15583 Brookpark Rd., Cleveland 35, Ohio
Glo-Quartz Electric Heater Co., Inc. 109
4066 Erie St., Willoughby, Ohio
Graver Water Conditioning Co.
216 W. 14th St., New York 11, N. Y.
Grieve-Hendry Co., Inc. 119
1338 N. Elston Ave., Chicago 22, Ill.
Gumm Chemical Co., Inc. Frederick Inside Front Cover
538-542 Forest St., Kearny, N. J.
Hamilton Emery & Corundum Co. 122
Chester, Mass.
Hammond Machinery Builders, Inc. 107
1601 Douglas Ave., Kalamazoo 54, Mich.
Hammond Solvents Recovery Service 126
241 Brunswick St., Hammond, Ind.
Handy & Harman
82 Fulton St., New York 38, N. Y.
Hanson-Van Winkle-Munning Co. 27, 93
Matawan, N. J.
Hardwood Line Mfg. Co. 123
2022 N. California Ave., Chicago 47, Ill.
Harrison & Co., Inc.
487 Groveland St., Haverhill, Mass.
Harshaw Chemical Co., The 6, 7
1945 E. 97th St., Cleveland 6, Ohio
Heathath Corp.
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1301 Parsons Ct., Rocky River 16, Ohio
Ideal Chemical Co. 126
1499 Dean Dr., So. Euclid 21, Ohio
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Kelite Corp. 28
81 Industrial Rd., Berkeley Hgts., N. J.
Kocour Company 34
4802 S. St. Louis Ave., Chicago 32, Ill.
Koppers Co. Inc., Chemicals & Dyestuffs Div.
Pittsburgh 19, Pa.
Kosmos Electro-Finishing Research, Inc.
140 Liberty St., Hackensack, N. J.
Kushner, Dr. Joseph B. 122
621 S. Norman, Evansville 14, Ind.
Lasalco, Inc. 33
2820-38 Lasalle St., St. Louis 4, Mo.
Lea Mfg. Co. 35, 118
16 Cherry Ave., Waterbury 20, Conn.
Lea Michigan, Inc.
14459 Wildemere, Detroit 38, Mich.
Lea-Ronal, Inc. 36
139-20 109th Ave., Jamaica 35, N. Y.
L'Hommedieu & Sons Co., Chas. F. 5
4521 Ogden Ave., Chicago 23, Ill.
Lindale Equipment & Supply Corp. 124
504 Smith St., Brooklyn 31, N. Y.
Lowe Brothers Co., The
Dayton 2, Ohio
Macarr, Inc. 114
4360 Bullard Ave., Bronx 66, N. Y.
MacDermid, Inc. Back Cover
Waterbury 20, Conn.
Magnus Chemical Co., Inc. 103
11 South Ave., Garwood, N. J.
Mahon Co., The R. C. 20
Detroit 34, Mich.
Manhattan Rubber Div., Raybestos-Manhattan, Inc. 102
6 Willett St., Passaic, N. J.
Manning, Maxwell & Moore, Inc. Consolidated Ashcroft Hancock Div. 44
Stratford, Conn.
McGean Chemical Co. 24
1040 Midland Bldg., Cleveland 15, Ohio
Meaker Company, The
1633 S. 55th Ave., Chicago 50, Ill.
Metal & Thermit Corp. 40, 58
Rahway, N. J.
Michigan Buff Co., Inc. 125
3503 Gaylord Ave., Detroit 12, Mich.
Motor Repair & Mfg. Co., The 126
1555 Hamilton Ave., Cleveland 14, Ohio
Murray-Way Corp. 25
P. O. Box 180, Maple Rd. E., Birmingham, Mich.
Nankervis Co., Geo. L.
15300 Fullerton Ave., Detroit 27, Mich.
National Polymer Products, Inc.
2120 Fairmount Ave., Reading Pa.
National Ultrasonic Corp.
111 Montgomery Ave., Irvington 11, N. J.
New Holland Machine Co.
New Holland, Pa.
N. J. Thermex Co., Inc. 105
535 Bergen St., Harrison, N. J.
Nordson Corp.
Jackson St., Amherst, Ohio
Northwest Chemical Co.
9310 Roselawn Ave., Detroit 4, Mich.
Norton Co. 22
1 New Bond St., Worcester 6, Mass.
Nuodex Products Co.
Elizabeth, N. J.
Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.
Packer Machine Co. 104
456 Center St., Meriden, Conn.
Perfecto-Peen Div., Aero-Test Equipment Co., Inc. 108
P. O. Box 10627, Dallas 7, Texas
Pesco Plating Equipment Corp. 124
75 Wythe Ave., Brooklyn 11, N. Y.
Pfizer & Co., Inc., Chas.
630 Flushing Ave., Brooklyn 6, N. Y.
Phelps Dodge Refining Corp.
300 Park Ave., New York 22, N. Y.
Plating Products, Inc. 46
1509 N. Washington, Kokomo, Ind.
Plating Service & Equipment Corp. 125, 127
3620 Hart St., Detroit 14, Mich.
Ramco Equipment Corp.
807 Edgewater Rd., New York 59, N. Y.
Randolph Products Co.
92 N. 12th St., Carlstadt, N. J.
Rapid Electric Co.
2881 Middletown Rd., Bronx 61, N. Y.
Raybestos-Manhattan, Inc. Manhattan Rubber Div. 102
Passaic, N. J.
Reliable Industrial Equipment Co. 125
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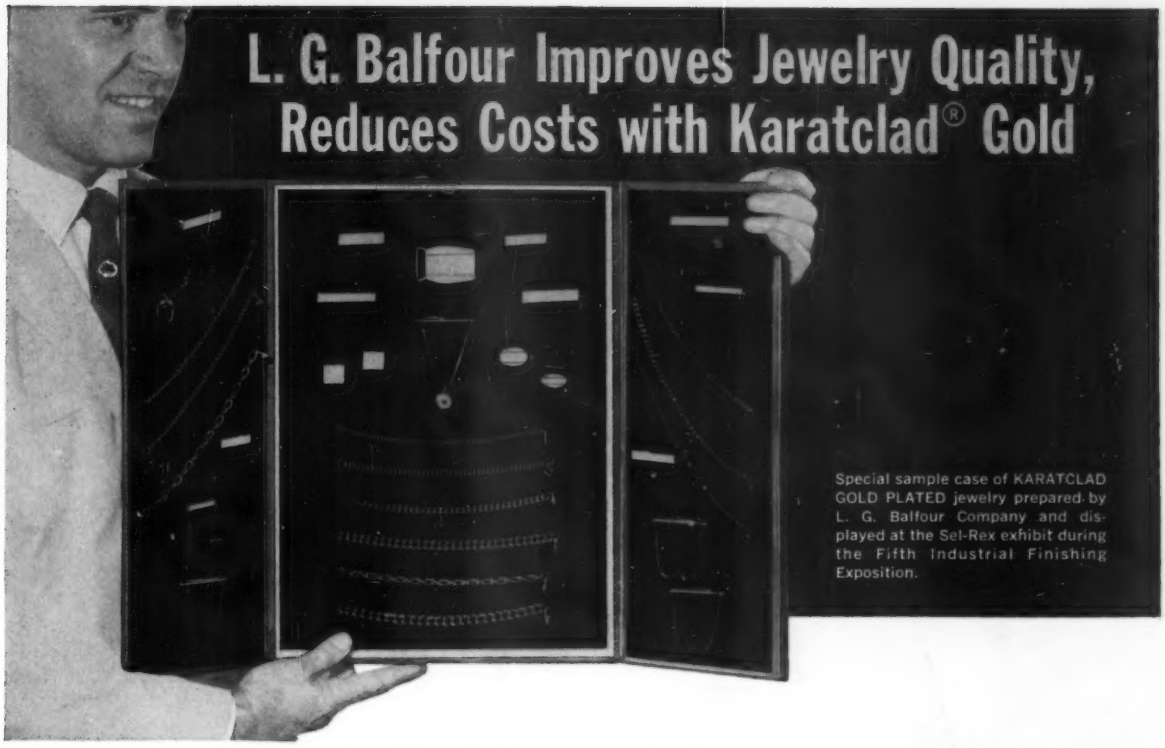
Robertshaw Fulton Controls Co., Fulton Sylphon Div.
Knoxville 1, Tenn.
Rona Laboratories Inc.
E. 21st & E. 22nd Sts., Bayonne 3, N. J.
Sandez, Inc.
61 Van Dam St., New York 13, N. Y.
Saran Lined Pipe Co. 19
2415 Burdette Ave., Ferndale 20, Mich.
Schaffner Mfg. Co., Inc. 121
22 Herron Ave., Emsworth, Pittsburgh 2, Pa.
Sel-Rex Corp. Inside Back Cover
75 River Rd., Nutley 10, N. J.
Servi-Sure Mfg. Co. 116
131 N. Green St., Chicago 7, Ill.
Sethco Mfg. Co. 112
2286 Babylon Turnpike, Merrick, L. I., N. Y.
Siefen Co., J. J. 113
5643 Lauderdale, Detroit 9, Mich.
Simonds Abrasive Co.
Tacony & Fraley Sts., Philadelphia 37, Pa.
Sommers Bros. Mfg. Co. 122
3439 No. Broadway, St. Louis 7, Mo.
Special Chemicals Corp.
100 S. Water St., Ossining, N. Y.
Stevens, Inc., Frederic B. 14
1808 - 18th St., Detroit 16, Mich.
Stokes Corp, F. J. 99
5500 Tabor Rd., Philadelphia 20, Pa.
Storts Welding Co., Inc. 117
38 Stone St., Meriden, Conn.
Stutz Co., The 45
4430 W. Carroll Ave., Chicago 24, Ill.
Surety Rubber Co.
Carrollton, Ohio
Technic, Inc. 57
88 Spectacle St., Cranston, R. I.
Titanium Products Corp.
9301 French Rd., Detroit 13, Mich.
True Brite Chemical Products Co. 117
P. O. Box 31, Oakville, Conn.
Turco Products, Inc. 13
24600 S. Main St., Wilmington, Calif.
Udylite Corp., The 21, 52, 53
Detroit 11, Mich.
Unit Process Assemblies, Inc. 44
61 East 4th St., New York 3, N. Y.
U. S. Galvanizing & Plating Equipment Corp.
31 Heyward St., Brooklyn 11, N. Y.
U. S. Stoneware 15
Akron 9, Ohio
Unitron Instrument Div., United Scientific Co. 110
204-206 Milk St., Boston, Mass.
Univertical Corp. 114
14841 Meyers Rd., Detroit 27, Mich.
Virginia-Carolina Chemical Corp.
401 E. Main St., Richmond 8, Va.
Vulcanium Corp.
3080 Skokie Valley Hwy., Highland Park, Ill.
Worthy Products Co. 126
Box 123, Temple, Pa.
Wyandotte Chemicals Corp. 38, 39
Wyandotte, Mich.
Zialite Corp. 120
92 Grove St., Worcester 5, Mass.

L. G. Balfour Improves Jewelry Quality, Reduces Costs with Karatclad® Gold



Special sample case of KARATCLAD GOLD PLATED jewelry prepared by L. G. Balfour Company and displayed at the Sel-Rex exhibit during the Fifth Industrial Finishing Exposition.

Much of the emblematic and insignia-type jewelry of L. G. Balfour Company, Attleboro, Massachusetts, is produced well in advance of inflexible delivery schedules. Protected, as well as beautified, with a KARATCLAD GOLD PLATE,* this jewelry retains its sparkling finish—absolutely no sign of tarnish or discoloration—regardless of how long the "shelf life." Expensive polishing or buffing prior to shipment has been completely eliminated, reducing costs appreciably.

"The quality of our products on which KARATCLAD GOLD is used has been improved greatly," says Mr. J. R. Brooks, Vice President of Production at L. G. Balfour. "Our KARATCLAD GOLD PLATED line retains the warmth and beauty of gold far longer than with any comparable material we have used in the past."

More and more prominent jewelry manufacturers are turning to KARATCLAD to help them produce quality products, while lowering costs to meet foreign competition. Here are just some of the advantages KARATCLAD offers you:

• **FREEDOM OF DESIGN**—make your product entirely of easy to work base metal. With KARATCLAD, you apply a substantial layer of gold — jeweler's finish from the bath — as the last step in manufacturing. None of the physical limitations of mechanically coated stock.

• **CHOICE OF COLORS** — select the color your customers want — no variation from batch to batch — whether the work is wired, racked or even barrel plated.

• **ECONOMICAL PRODUCTION**—no buffing, no polishing, no lacquering. No costly frequent refining as required by so called "color golds." The original KARATCLAD bath has been operating on a mass production basis for nearly two years, without refining or color adjustment. No need to inventory costly mechanically coated stock.

• **EASY TO USE**—KARATCLAD now comes in ready-mixed solution form eliminating time consuming preparation. Simply pour KARATCLAD from its unbreakable vinyl container into your tank—no mixing, no fussing.

For samples of KARATCLAD GOLD on your own products — write, wire or 'phone . . . we'll make all arrangements at no obligation.

For complete literature, including a copy of the new applicable FTC Trade Practice Rules, ask for #FTC-G.

*Patented Process

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SEL-REX CORPORATION

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Balfour uses the KARATCLAD GOLD PLATING PROCESS—color matched to their requirements—in a Sel-Rex JET PLATER. This complete precious metals plating "plant" provides valuable versatility to Balfour production by permitting economical processing of both long and short runs in a single facility.

Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies.

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SERVICE • A • BILITY means you can call on the skilled chemists, metallurgists and technicians in MacDermid's Research or Analysis or Customer Service laboratories to help solve all your metal finishing problems.

SERVICE • A • BILITY means you can call for a wide range of fresh ideas available from our product engineers and sales representatives with their technical training and idea-sharing techniques. Next time someone says "Service" . . . check to be sure "Ability" is part of the deal!